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A. Gray

UMBELLIFERÆ

—OF—

E. UNITED STATES.

JOHN M. COULTER AND J. N. ROSE.

WITH NINE PLATES

[From Botanical Gazette, 1887.]

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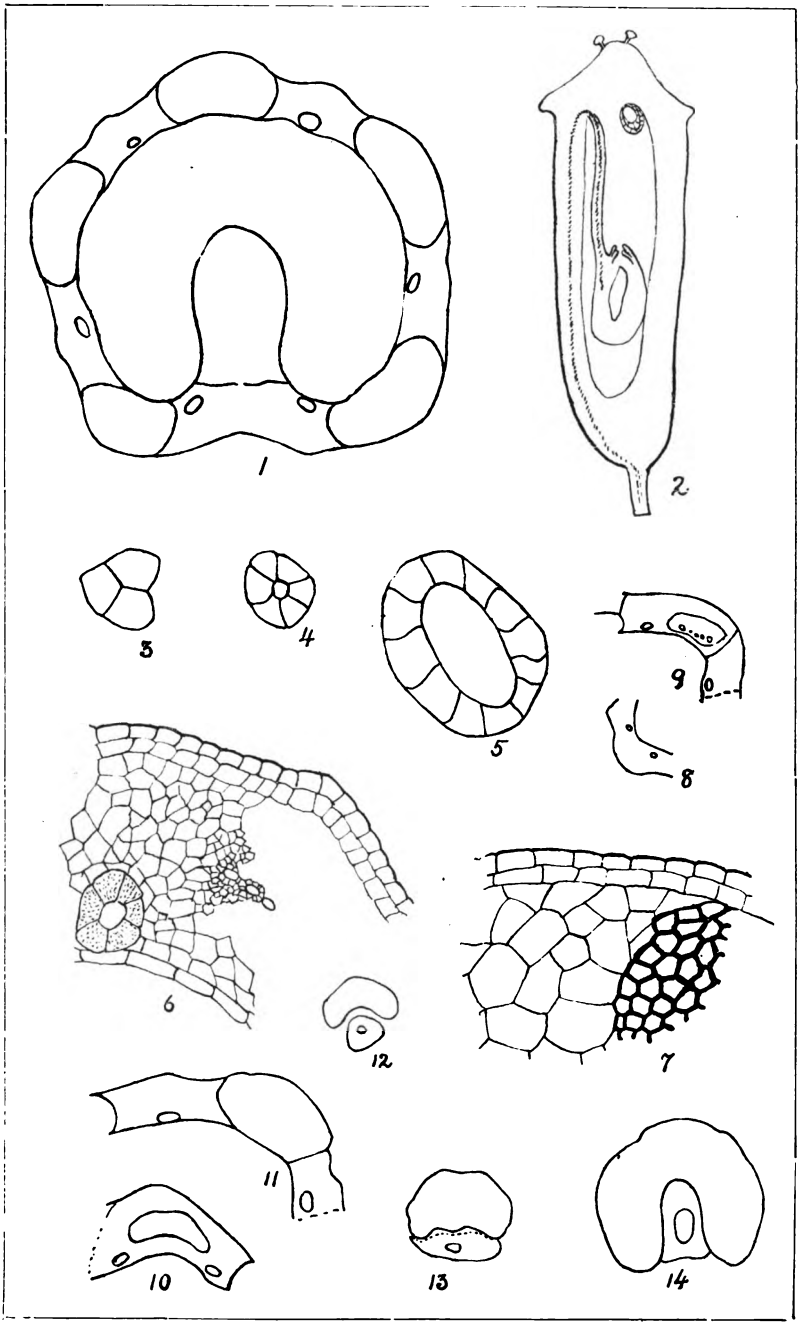

COULTER and ROSE on DEVELOPMENT OF THE UMBELLIFER FRUIT.

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VOL. XII. NO. 10.—BOTANICAL GAZETTE.—OCT., 1887.

Development of the Umbellifer Fruit.[1]

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE XIV.)

In no family of plants does the fruit furnish more certain diagnostic characters than in the Umbelliferæ. So definite are they that the fruit alone can be made to determine the genus, and in most cases the species, while in every case it is an essential part of the description. This indicates at once an unusual amount of differentiation in the fruit structures, and a great diversity in its display. During the past year we have been making a critical examination of all our Umbelliferæ east of the 100th meridian, and this has directed our special attention to the minute structure of the fruit of all our species. This study has shown that while the grouping of these structures is very diverse, and hence available for diagnostic purposes, the structures themselves are simple and few in number.

It was a matter of interest to study the development of these peculiar structures, and for this purpose the common Chærophyllum procumbens was selected as a type, as its fruit contains all the structures found in the family. Beginning with ovary wall composed of undifferentiated parenchyma, supported by simple fibro-vascular elements, the changes wrought in the maturing ovary and then in the ripening fruit were traced.

A description of the structure of the mature fruit of Umbellifers in general will make plainer the questions to be answered by a study of its development. The two carpels face each other, and are in contact at first by their commissural or ventral faces, but eventually separate. The fruit is compressed laterally (at right angles to the plane of the commissural faces) or dorsally (parallel with the commissural plane), or not at all. As the two carpels are but repetitions of each other, a description of structure may be confined to a single one. The surface of the carpel is usually marked by five ribs or wings longitudinally placed. The two nearest the commissure are the laterals; a single dorsal one occurs on

[1]Read at the meeting of the A. A. A. S., New York, August, 1887.

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the back of the carpel, while the pair between the dorsal and the laterals are the intermediates. In addition to these five primary ribs or wings secondary ones may appear (as in Hydrocotyle Asiatica), and even become more prominent than the primary ones (as in Daucus and Trepocarpus); or occasionally even all external indications of ribs may be lacking (as in Sanicula). The presence of these ribs or wings, their varying size and structure, furnish good diagnostic characters. At the summit of each carpel a stylopodium may be developed, of various appearance, from prominently thick conical to a flat or depressed cushion.

The general structure of the pericarp wall well represents the typical leaf structure, with under and upper (that is, outer and inner) epidermal layers bounding a more or less developed mesophyll (figs. 6, 7). It is in the mesophyll region that the characteristic fruit structures are developed. The constant occurrence in the outer epidermal region of the two distinct layers of epidermal cells suggests that the outer layer represents the connate calyx, while the inner is the true epidermis of the pericarp. The mesophyll region of the pericarp is naturally separated into three structures: (1) oil-ducts, (2) strengthening cells, and (3) undifferentiated parenchyma.

I. Oil-ducts.—These occur in varying number, size and position in the different genera, and are of such constancy as to furnish most valuable characters. By far the most common position for oil-ducts is in the intervals between the ribs, where they occur singly or in groups. In this position they may occur close against the inner epidermal layer, or centrally in the pericarp section, while in Cryptotænia and Erigenia they seem to be developed in the inner epidermal layer itself. In Æthusa, Cœlopleurum and Cryptotænia oil-ducts occur both in the intervals and beneath the ribs. In some cases, as in Polytænia, there are two sets of oil-ducts, one forming almost a continuous layer about the seed-cavity, the other composed of smaller ducts, and scattered through the very thick pericarp. In Zizia there are also smaller accessory ducts in the ribs. In Conium there is no development of oil-ducts, but the whole inner epidermal layer of the pericarp becomes a secreting layer. In Hydrocotyle, on the other hand, in the absence of oil-ducts groups of secreting cells occur just beneath the outer epidermis of the pericarp, and in some species eventually break through it, forming superficial oil vesicles. Anthriscus and some Bupleurums

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have neither oil-ducts nor secreting cells. In Osmorhiza the mature fruit usually gives no trace of oil-ducts, while the immature fruit may show groups of four to six oil-ducts in the intervals and one to three in the ribs themselves. The obliteration of oil-ducts on approach to maturity would seem to make them represent aborted organs in this case, and may account for the discrepancy of opinion concerning the oil-ducts of certain genera. It is an interesting fact that this suppression of oil-ducts seems to involve the formation of an oily layer. In Osmorhiza the mature fruit has an oily layer about the seed, a region occupied in the immature fruit by a distinct line of oil-ducts. In Hydrocotyle, however, the isolated groups of secreting cells are such as always precede the formation of oil-ducts. In Hydrocotyle, therefore, the oil-ducts could be called rudimentary; in most Umbellifers they are oil-ducts proper; in Conium a secreting layer has been developed; while the development of the Osmorhiza fruit gives us distinctly all three phases. Hence, to summarize: (1) most genera have distinctly developed oil-ducts, variously placed, (2) a few have a layer of secreting cells, (3) some have groups of secreting cells, and (4) others have neither oil-ducts nor secreting cells, in fact, without any representation of this one of the three structures of the mesophyll.

II. STRENGTHENING CELLS.—Under this name we would define certain groups of cells, which are unlike enough in structure, but seem to serve the common purpose of strengthening the pericarp wall or its ribs. They usually occur beneath each rib, and are normally developed about the simple fibro-vascular elements of the pericarp wall (fig. 6). These fibro-vascular elements may eventually become obliterated. The group of strengthening cells may consist of fibrous tissue, sclerenchyma, sclerenchymatous parenchyma, or small-celled parenchyma. It may be well marked off from the surrounding tissues, as in the distinct thick-walled groups of Osmorhiza, Cryptotænia, Conium and Chærophyllum (figs. 1 and 7); or it may gradually merge into the surrounding tissue, as in Angelica, Thaspium, etc. In Hydrocotyle, Pastinaca and Heracleum the strengthening cells are developed in a broad continuous band about the seed-cavity; while in Sanicula, Conioselinum and Æthusa they seem to be entirely wanting. In the last named genus they may be found in the very tips of the prominent ribs, the position usually held by strengthening cells being occupied by large and

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loose parenchyma, the other structures remaining normal. Strengthening cells are thus unlike in elements and position, are in groups of varying size and distinctness, or in bands, or may be wanting entirely. From these facts important characters may be obtained for generic grouping.

III. UNDIFFERENTIATED PARENCHYMA.—This has merely the negative character of not being transformed into either strengthening or secreting cells. Its abundance is dependent upon the development of the strengthening cells. It will be seen, however, that although it furnishes no diagnostic characters, it is probably most concerned in the growth of the pericarp.

Each carpel primarily contains two ovules, one of which soon becomes aborted (fig. 2), although it is developed sufficiently to display its nucellus and integuments, as well as its anatropous character. The other ovule eventually occupies the whole space of the ovarian cavity.

The fibro-vascular connection of the ovules with the plant axis is as follows: A fibro-vascular bundle enters each carpel at its base, thus making it a lateral out-growth from the axis, while the axis itself continues its growth in the carpophore. The carpellary bundle almost at once subdivides into five branches, and these branches ascend the carpellary wall beneath the five primary ribs.

The two lateral bundles (that is, those beneath the lateral ribs) are the largest, as they contain the fibro-vascular elements to be distributed to the ovules. These lateral bundles pass in the carpellary wall to the very summit of the carpel, and then send a branch inwards and downwards into the funiculus of the anatropous ovule (fig. 2). The remaining elements of the fibro-vascular bundle pass on to the floral organs and stylopodium. It will be seen that in this case, as in Compositæ, the ovules are lateral outgrowths. A point or two in the development of the ovule may be mentioned in this connection. At first both ovules lie at the summit of the ovarian cavity, but soon, by the development of the funiculus, one is thrust toward the bottom, with the micropyle near the center of the cavity (fig. 2). It is in this position that the pollen tubes are seen to enter the micropyle, and subsequently the ovule develops so as to fill the ovarian cavity. The aborted ovule is retained at the summit of the cavity, its funiculus never developing, and its micropyle out of reach of the pollen-tubes, even if its nucellar structures were developed to receive them,

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To recur now to the mature seed, it will be found to consist mainly of a much developed embryo-sac, filled with endosperm and a small embryo. The embryo-sac never entirely replaces the nucellus, more or less of the nucellar tissues being found on the commissural side, either pressed against the flat or concave face of the embryo-sac or embraced in its infolding (figs. 12, 13, 14). Important characters have been obtained from the commissural face of the seed, based upon the fact that it may be convex, plane, concave, or more or less involute. Great care should be exercised, however, to obtain seed of perfect maturity, or a comparison on this basis will amount to nothing. All seeds at first have a convex or plane face, and the amount of concavity or infolding will depend upon the development of the embryo-sac. In some cases the embryo-sac, instead of developing uniformly, develops strongly towards the commissure on the two sides, resulting in a concave or involute seed-face. This variation may occur in the mature fruits of a single species (as in Eulophus), so that there may be found plane or concave seed-faces in one and the same plant.

Having described the structures to be found in the mature fruit in general, it remains to describe the method of their development in Chærophyllum procumbens.

I. Development of oil-ducts.—In very young buds groups of 3 or 4 parenchyma cells of the pericarp, next the inner epidermis, begin to be set apart for the formation of oil-ducts (fig. 3). The first indication of this is in the fact that they become secreting cells, and are discolored by the characteristic oily contents, and also become larger than the surrounding parenchyma cells. The 3 or 4 secreting cells then begin to divide radially, so that, at about the time of anthesis, the resulting intercellular space becomes an oil-duct of small caliber, with 6 to 8 secreting cells (fig. 4).

This radial division continues as the fruit matures, thus gradually enlarging the caliber of the duct, until it reaches its full size, with a dozen or so secreting cells (fig. 5). The ducts are thus enlarged intercellular spaces, developed by the radial division of the surrounding secreting cells, and simply act as reservoirs.

In Hydrocotyle (in which there are only groups of secreting cells and no ducts developed) the absence of ducts seems to be explained by the lack of power of radial division in the secreting cells. In Osmorhiza this power is also poorly developed, so that while the ducts are at first outlined, they

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are presently encroached upon and obliterated by the development of contiguous cells, thus forming a continuous oily layer composed of obliterated ducts and intervening secreting cells. In Conium no ducts are developed, because groups of cells are not set apart as secreting cells, but only a single layer of cells, and there can thus be no development of intercellular spaces, although the power of radial division is retained. Hence Hydrocotyle has no oil-ducts because its secreting cells lack the power of radial division; Conium has none because its secreting cells are in a plane instead of in groups; while most Umbellifers have oil-ducts because their secreting cells are in groups, and also have the power of radial division. The only other phase is the entire absence of secreting cells, as in Anthriscus and certain Bupleurums.

II. DEVELOPMENT OF STRENGTHENING CELLS.—In young buds there is no setting apart of this region from the ordinary parenchyma of the pericarp wall (fig. 8). Upon approaching anthesis, however, the parenchyma cells surrounding each fibro-vascular bundle sub-divide (fig. 9), and at anthesis quite a distinct group of small parenchyma cells is discovered beneath each rib (fig. 10). This comparatively small size is due not only to cell division and moderate growth but also to the strong growth of the surrounding undifferentiated parenchyma. While the region is indicated before anthesis it does not become really a region of strengthening cells until the development of the fruit. It is then that the walls begin to thicken, until at maturity a group of strengthening cells is composed of firm, heavy-walled tissue (fig. 7). The contained fibro-vascular elements are encroached upon, and for the most part obliterated, as they are really functionless after anthesis. This differentiation proceeds centrifugally from the fibro-vascular elements as a center, at first a comparatively small area being included. The surrounding parenchyma is gradually invaded, until in some cases the whole thickness of the pericarp wall is concerned (figs. 1 and 11). The amount of primary parenchyma transformed into strengthening cells varies widely. In Chærophyllum this structure reaches probably its maximum development, occupying the whole thickness of the pericarp wall, separating the undifferentiated parenchyma into isolated patches, and also being very thick-walled. In certain genera the strengthening-cell groups of the mature fruit are in the same condition as those of Chærophyllum at anthesis, viz.: differing from the surrounding parenchyma only in smaller size, and

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never becoming thick-walled, as in Angelica. Continuous bands of strengthening cells, as in Hydrocotyle, are always developed next to the seed cavity, in the same position as the continuous secreting layers. Hence we find strengthening-cell structures developing in bands or groups, and when in groups they may become thick-walled or not. In certain genera this kind of differentiation is entirely lacking, while in Æthusa we find the anomalous feature of the strengthening-cell regions developing a large-celled and loose parenchyma.

III. DEVELOPMENT OF UNDIFFERENTIATED PARENCHYMA.—This region, lying between the strengthening-cell groups, is chiefly concerned in the development of the pericarp wall in size. After anthesis there seems to be but little increase in the thickness of the pericarp wall, the growth being chiefly extension. This extension is effected by the radial division of the undifferentiated parenchyma cells, the amount of tangential cell division being comparatively small. The exception to this is found in ribs and wings, which represent regions of strong tangential cell division in the undifferentiated parenchyma.

In this way the three structures of the pericarp wall are built up, and in their endless, but simple and constant variations, we find a clew to the classification of a group of plants otherwise hopelessly confused.

EXPLANATION OF PLATE XIV.—All the figures are from Chærophyllum procumbens Fig. 1, Cross section of mature carpel, showing large strengthening-cell areas; small solitary oil-ducts in the intervals, two on the commissural side; and a deeply sulcate seed-face. Fig. 2, Longitudinal section of carpel at anthesis, showing abortive ovule; developing ovule thrust down into ovary cavity ready to receive pollen-tubes seen at summit of stylopodium, and which should have been represented as passing through the ovary cavity and entering the micropyle; and fibro-vascular connections of ovule. Figs. 3, 4 and 5, Development of the oil-duct. Fig. 6, Section of ovary wall at anthesis, showing beginning of a strengthening-cell group about the simple fibro-vascular elements; a developing oil-duct; and inner and outer epidermal layers, the latter of two layers, probably indicating a connate calyx. Fig. 7, Mature strengthening cells, sharply marked off from surrounding parenchyma. Figs. 8, 9, 10 and 11, Development of strengthening-cell area, fig. 10 being taken at anthesis. Figs. 12, 13 and 14, Cross sections of developing seed.

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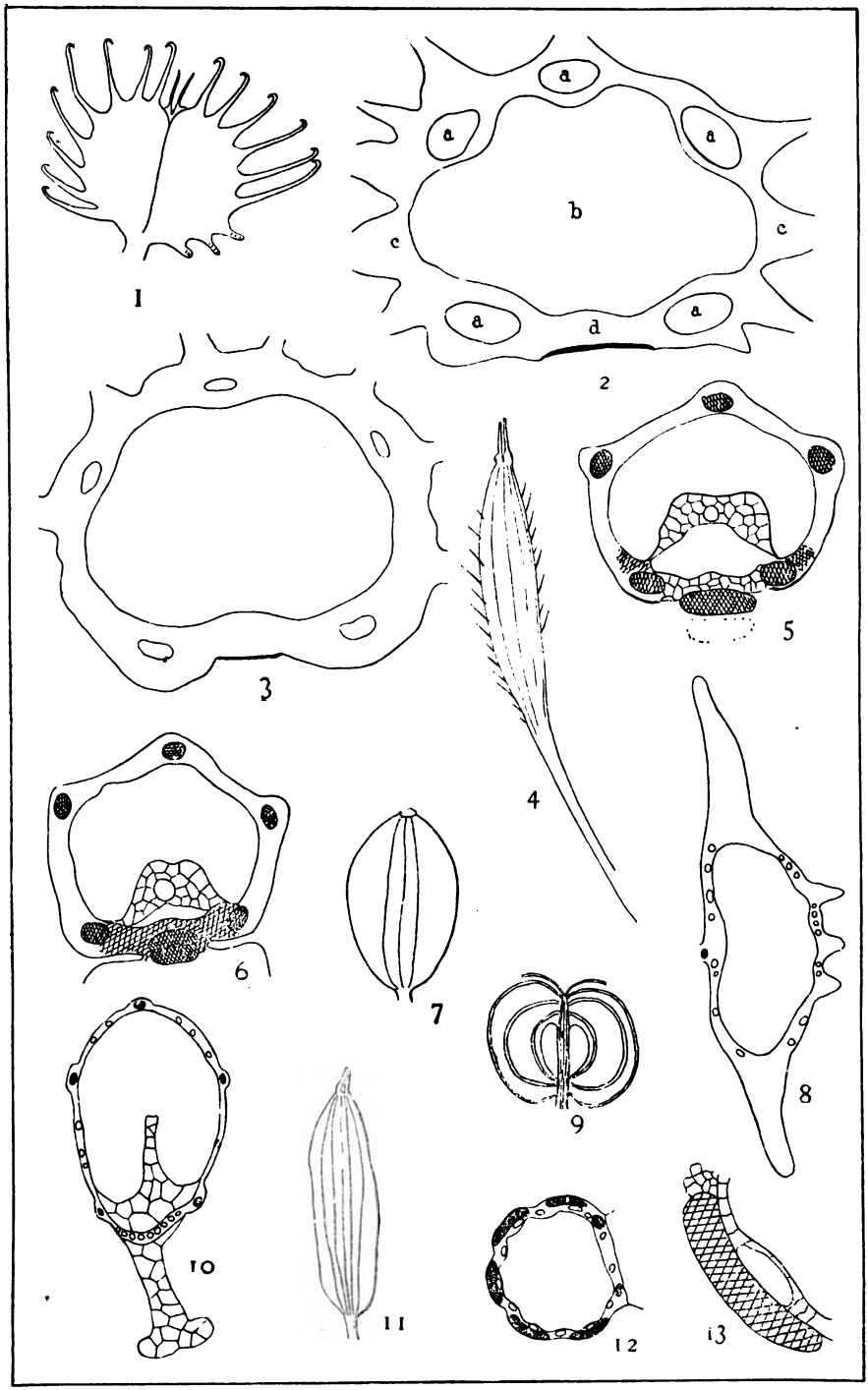

COULTER and ROSE on UMBELLIFERÆ.

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[From the BOTANICAL GAZETTE, Vol. xii, No. 1.]

Notes on Umbelliferæ of E. United States. I.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE I.)

Our species of Umbelliferæ have always been more or less perplexing, chiefly on account of the attempt to discriminate them without mature fruit. For this reason, it has seemed to us a helpful thing to take up certain Umbelliferæ and present characters that can be used with reasonable certainty. It is well known that the best characters are obtained from the mature fruit, hence it is safe to give as general advice that no attempt be made to determine species of Umbelliferæ in its absence. Of course there are certain forms that can be recognized without fruit, but the rule holds good. The fruit should be examined both as to its surface and transverse section, and these taken together furnish reliable characters. It hardly needs to be said that the fruit is made up of two carpels and that it is superficially marked by more or less prominent ribs. Five ribs is the normal number for each carpel, one being dorsal (the commissural side being ventral), two lateral (nearest the commissural side), and two intermediate. These ribs may be connected by reticulations or not, may be developed into prominent wings or corky ridges, or may be suppressed entirely. Secondary ribs may also be developed in the intervals between the five primary ribs. Thin transverse sections should be made as near the middle of the carpel as possible, and the varying number, position and size of the oil-ducts, the outline of the seed section, the nature of the pericarp, and the rib sections, will be found to furnish most satisfactory characters. In figure 2, *a* indicates the oil-ducts, *b* the seed section, *c* the pericarp, *d* the commissural face. Frequently groups of thick-walled or smaller cells occur, usually subtending the ribs and even indicating their position in the absence of surface appearance. These groups, which will probably be helpful in classification, may be called "strengthening cells" for convenience.

In the following series of notes all the species east of the 100th meridian will be illustrated, at least by the tranverse section of the carpel.

SANICULA L.—Fruit globular, covered with hooked prickles: carpels without ribs, each with 5 oil-ducts (2 ventral and 3 dorsal) (figs. 1, 2 and 3).—One to three feet high,

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with 3 to 7-parted leaves; radical long-petioled; cauline short-petioled or sessile; their divisions sharply cut and serrate. Involucre and involucels few-leaved. Flowers greenish or yellowish. May to August.

1. **S. Canadensis** L. Spec. 235. Leaf-divisions 3 to 5: sterile flowers comparatively few, short pedicelled: style shorter than prickles: oil-ducts mostly large, occupying nearly the whole thickness of the pericarp; seed-section deeply sinuous in outline (figs. 1 and 2).—Common throughout the region.

2. **S. Marylandica** L. Spec. 235. Leaf-divisions 5 to 7: sterile flowers numerous, longer pedicelled: style much longer than prickles: oil-ducts smaller, in thicker pericarp; seed-section nearly entire (fig. 3).—Common throughout the region.

OSMORHIZA Raf.—Fruit linear-oblong, long tapering at base, deeply grooved at commissure, bristly: carpels with 5 prominent primary ribs, each subtended by a well defined group of strengthening cells, section nearly pentagonal, no oil-ducts; seed-section more or less deeply concave on the inner face (figs. 4, 5 and 6).—One to three feet high, with aromatic roots. Leaves ternately compound; leaflets ovate, strongly toothed or cleft. Involucre and involucels few-leaved. Flowers white. May to June.

1. **O. longistylis** DC. Prodr. iv. 232. Slightly pubescent or smooth: styles slender, nearly as long as the ovary (not the fruit): seed-section deeply and broadly concave (figs. 4 and 5).—Throughout the northern states and westward.

2. **O. brevistylis** DC. Prodr. iv. 232. Villous pubescent: styles conical, very short: seed-section less deeply and more narrowly concave (fig. 6).—Throughout the northern states and southward to N. Carolina. It is a question whether the specific name *O. dulcis* Raf. may not have the prior claim. The western *O. nuda* Torr. has the seed-section still less concave and strengthening cells less developed and well represents a third member in the series as here arranged.

CONIOSELINUM Fisch.—Fruit oblong, flattened dorsally, smooth: carpels with 5 prominent primary ribs, the lateral ones extended into broad wings; oil-ducts 1 to 4 in the intervals, 4 to 8 on the commissural side; seed slightly concave on the inner face (figs. 7 and 8).—One to five feet high, sometimes smaller, smooth. Leaves 2 to 3-pinnately compound, with inflated petioles. Involucre and involucels few-leaved, the former sometimes wanting, the latter awl-shaped. Flowers white. August to October.

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1. **C. Canadense** Torr. & Gray, Fl. i. 619. Leaflets pinnatifid: lateral wings nearly as broad as the seed; oil-ducts 2 or 3 in the intervals, sometimes 1 or 4.—Swamps and cold cliffs from Vermont to Minnesota and northward, also southward along the high mountains to N. Carolina, and in Indiana.[1]

The discovery of a quantity of fine fruiting specimens has enabled us to make a careful examination of fruit characters. Bentham & Hooker have referred this species to Selinum, which is characterized by single oil-ducts in the intervals, rarely 2. Their decision, however was based upon immature fruit, while our recently collected specimens show 2 and 3 to be the usual number of oil-ducts in the intervals, sometimes 1, and rarely 4. This fact would put the species in Ligusticum as defined by Bentham & Hooker. Its characters of broad lateral wings, inflated petioles, and pinnately compound leaves, however, make it so distinct from our own Ligusticums that it seems proper to retain the genus Conioselinum for this species. Possibly Conioselinum Fischeri is properly referred to Selinum. C. Canadense, if it could be included under Selinum, would belong to the broad lateral-winged section Euselinum, but with the oil-ducts of Ligusticum it must either stand as an intermediate genus between Ligusticum and Selinum or these two genera must be merged into one. But Conioselinum is more closely related to the Angelica group than to the Selineæ. In fact, its broad lateral wings and only somewhat prominent dorsal and intermediate ribs at once separate it from Selineæ and include it among Angeliceæ even to a superficial observer, a relationship which the minute structure of the fruit confirms. It is a question whether it should not be included with Angelica and Archangelica in a single genus. The only characters which serve to separate it from them are the much more dissected foliage (which does not count for much) and the absence of prominent bundles of strengthening cells beneath each rib, especially conspicuous under the lateral ribs. These characters can be made to separate Conioselinum from the other members of the Angelica group, but whether they should be considered generic or sub-generic is a matter of doubt. It seems best for the present to consider this genus as intermediate in its characters between Selineæ and Angeliceæ.

ERIGENIA Nutt.—Fruit much flattened laterally, nearly round, notched at base and apex, thin between the incurved carpels, smooth: carpels very thin-walled, with 5 small pri-

[1] BOTANICAL GAZETTE, xi. 338.

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mary ribs; oil-ducts one to several in the intervals, 9 to 11 on the commissural side, which is drawn out (neck-like in section) into the narrow commissure; seed-section deeply two-lobed on the inner side, longitudinal section semilunar (figs. 9 and 10).—Low, diffuse, glabrous, from a deep round tuber, in early spring. Leaves ternately decompound, segments oblong. Involucels foliaceous. Flowers white.

1. **E. bulbosa** Nutt. Genera, i. 188. Span or so high: leaves radical except those subtending the imperfect umbels.—W. New York and Pennsylvania westward into the Mississippi valley.

CRYPTOTÆNIA DC.—Fruit linear-oblong, flattened laterally, somewhat grooved at the commissure, smooth: carpels with 5 small obtuse primary ribs; a single oil-duct beneath each rib and in each interval, 2 to 4 on the commissural side, which also contains two bundles of strengthening cells (in addition to those of the carpophore) besides those subtending each rib; seed-section roundish, slightly concave on the inner face (figs. 11 and 12).—One or two feet high, smooth. Leaves thin, 3-foliolate. Involucre none; involucels minute or none. Flowers white. June to September.

1. **C. Canadensis** DC. Mem. Umbel. 42. Leaflets large, ovate, 2 to 4 inches long, pointed, doubly serrate, lower ones lobed: fruit often becoming curved.—Canada to Minnesota and south to N. Carolina and Mississippi.—In this species the carpellary walls have two distinct layers, the outer being almost made up of the very broad bundles of strengthening cells, the inner composed of a single layer of large parenchyma cells set palisade fashion, and in which the oil-ducts always occur (fig. 13). This peculiar character, differing from any other umbellifer studied, serves to strengthen the position of Cryptotænia as a genus distinct from Pimpinella, to which Bentham and Hooker consider it too closely allied, as in Pimpinella there is no such inner layer and the bundles of strengthening cells are very small and widely separated.

EXPLANATION OF PLATE I.—Fig. 1 Fruit of Sanicula Canadensis. Fig. 2. Section of carpel of same: *a*, oil-ducts; *b*, seed section: *c*, pericarp; *d*, commissural face Fig. 3 Section of carpel of S. Marylandica. Fig. 4. Fruit of Osmorhiza longistylis. Fig. 5. Section of carpel of same. Fig. 6. Section of carpel of O. brevistylis. Fig. 7. Fruit of Conioselinum Canadense. Fig. 8. Section of carpel of same. Fig. 9. Fruit of Erigenia bulbosa. Fig. 10. Section of carpel of same. Fig. 11. Fruit of Cryptotænia Canadensis. Fig. 12. Section of carpel of same. Fig. 13. Section of carpel wall of same. Figs. 1 and 4×2½; 7, 9 and 11×5; transverse sections×27; 13×125.

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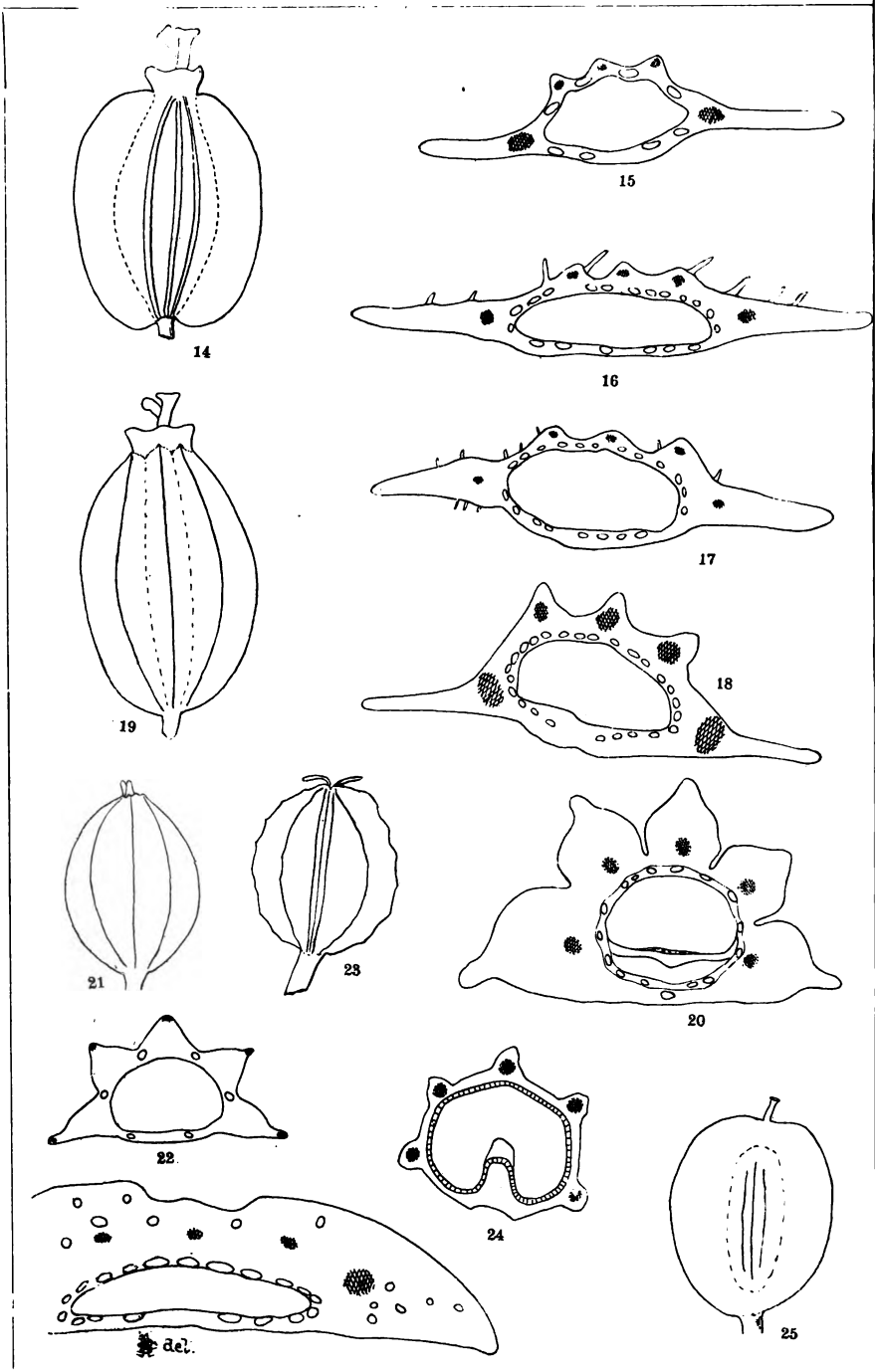

COULTER and ROSE on UMBELLIFERÆ.

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[From the BOTANICAL GAZETTE, Vol. xii, No. 3.]

Notes on Umbelliferæ of E. United States. II.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE II.)

ANGELICA L.—Fruit strongly flattened dorsally, broadly winged at the commissure: carpel with 5 strong primary ribs, each with a group of strengthening cells,[1] the 2 lateral extended into broad wings, distinct from those of the other carpel, forming a double-winged margin to the fruit: oil-ducts one to several in the intervals or indefinite, 2 to 10 on the commissural side (figs. 14–18).—Stout perennials, with ternately or pinnately compound leaves, large terminal umbels, scanty or no involucre, small many-leaved involucels, and white or greenish flowers.—Incl. *Archangelica* Hoffm., excl. *A. Gmelini* DC.—Archangelica is referred to Angelica by Maximowicz, Bull. Acad., Petersb., 19. 273. The only characters serving to separate Archangelica from Angelica break down. The number of oil-ducts in the intervals, while usually one in Angelica, in Angelica Curtissii may be two, or even three, as well in the dorsal intervals as in the lateral; while in Archangelica hirsuta the oil-ducts may be reduced to one or two in the intervals. The generic relation of neither of these species can be determined by any character drawn from the oil-ducts, and plac-

[1] In January GAZETTE, p. 14, third sentence from bottom, in contrasting the characters of Angelica and Conioselinum, the last clause ("especially conspicuous under the lateral ribs") might be understood to refer to Conioselinum. It refers to Angelica.

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ing Angelica Curtissii and Archangelica hirsuta together the other Archangelicas must follow. Also, the adherence of the seed to the pericarp is hardly a usable character, as in Archangelica hirsuta it becomes loose very tardily, and in most (even mature) specimens appears as completely adherent as in Angelica Curtissii. Sometimes the same is true in A. dentata also. Archangelica Gmelini we do not consider a member of Angeliceæ at all.

* Seed adherent to pericarp: oil-ducts one to several in the intervals: uppermost leaves mostly reduced to large inflated petioles.

1. **A. Curtissii** Buckley, Am. Jour. Sci. 1. 45. 173. Smooth: leaves twice ternate or the divisions quinate; leaflets thin, ovate-lanceolate (1 to 3 in. broad), sharply and irregularly toothed: fruit smooth (1½ to 3 lines broad); oil-ducts mostly one in the intervals (sometimes 2 or 3), 2 to 6 on the commissural side (figs. 14, 15).—Along the Alleghanies from Pennsylvania to N. Carolina. Fl. August.

2. **A. hirsuta** Muhl. Cat. 2 ed. 30. Pubescent above: leaves twice pinnately or ternately divided; leaflets thickish, lanceolate to oblong (5 to 10 lines broad), serrate: fruit pubescent (2 lines broad); oil-ducts 3 to 6 in the intervals (sometimes 1 or 2), 6 to 10 on the commissural side (fig. 16). —*Archangelica hirsuta* Torr. & Gray, Fl. 1. 622; Chapman, 164; Gray, Manual, 193. *Angelica triquinata* Nutt. Genera, 1. 186.—Dry ground, New York to Minnesota, and southward to Tennessee and Florida. Fl. July.

* * Seed loose in pericarp: oil-ducts indefinite, somewhat evenly distributed, under the ribs as well as in the intervals: upper petioles not so prominent.

3. **A. dentata.** Slender, smooth: leaves ternate, with long slender petioles and few leaflets, which are small, lanceolate, coarsely toothed: umbels slightly pubescent: fruit smooth or pubescent; oil-ducts about 20, with 8 on the commissural side (fig. 17).—*Archangelica dentata* Chapman, Torr. & Gray, Fl. 1. 622; Flora, 164.—Dry pine barrens, Florida. Fl. July to September.

4. **A. atropurpurea** L. Spec. 251. Very stout, smooth, with dark purple stem: leaves 2 to 3-ternately divided; segments of 5 to 7 leaflets, which are lanceolate to ovate (1 to 1½ in. broad), sharply cut mucronate-serrate: umbels smooth: fruit smooth; ribs larger and with much more conspicuous

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groups of strengthening cells; oil-ducts 25 to 30, with 8 to 10 on the commissural side (fig. 18).—*Archangelica atropurpurea* Hoffm. Umbel. 161; Gray, Manual, 193.—Low river-banks, from New England to Pennsylvania, Minnesota, and northward. Fl. June.

CŒLOPLEURUM Ledeb.—Fruit globular-ovoid, round in section, or slightly flattened laterally: carpel with 5 very prominent thick corky primary ribs, about equal and none of them winged, each with a large group of strengthening cells: oil-ducts 1 in each interval, 1 (rarely 2) under each rib, and 2-4 on the commissural side: seed loose in the pericarp, plane or slightly concave on the inner face (figs. 19, 20).—Stout perennial, with 1-3-ternately divided leaves, few-leaved involucre and involucels, and greenish-white flowers. Fl. July.—The genus is well marked by its fruit characters. It clearly differs from the whole group of Angeliceæ in the absence of lateral wings, and in the fruit not being at all dorsally flattened. The flattening, if any, is slightly lateral, as in Ligusticum. From Ligusticum it differs in its very large ribs and single oil-duct in each interval; from Selinum in that it has oil-ducts beneath the ribs as well as in the intervals. It was referred by Bongard to Pleurospermum, but differs in having oil-ducts beneath the ribs, and in the face of the seed being mostly plane or very slightly concave.

1. **C. Gmelini** Ledeb. Fl. Ross. 2. 361. Stem 1-3 ft. high: leaflets ovate, acute, cut-serrate.—*Archangelica Gmelini* DC; Gray, Manual, 193. *A. peregrina* Nutt.—New England and northward, also in the Rocky Mountain region.

ÆTHUSA L.—Fruit ovate-globose, slightly flattened dorsally: carpel with 5 thick sharp primary ribs and no strengthening cells except in very tips of the ridges: oil-ducts one in each interval and two on the commissural side (figs. 21, 22).—Poisonous annuals, with 2 to 3-ternately compound leaves, divisions pinnate, ultimate segments small and many cleft, no involucre, long narrow involucels, and white flowers in July.

1. **Æ. Cynapium** L. A fetid, poisonous European herb, in cultivated grounds, from New England and Pennsylvania to Minnesota.

CONIUM L.—Fruit ovate, flattened laterally: carpel with 5 prominent wavy primary ribs, each with a large

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bundle of strengthening cells: oil-ducts none, but a layer of secreting cells next the seed: seed deeply and narrowly concave on the inner face (figs. 23, 24).—Poisonous biennials, with spotted stems, large decompound leaves with lanceolate pinnatified leaflets, narrow-leaved involucres and involucels, and white flowers in July.

1. **C. maculatum** L. A large branching European herb, in waste places throughout the Northern States.

POLYTÆNIA DC.—Fruit obovate to oval, much flattened dorsally: carpel with 5 primary ribs, the dorsal and intermediate small or obscure in the depressed back, the lateral forming broad thick corky wings closely contiguous to those of the other carpel and forming the margin of the fruit: oil-ducts 12 to 18 about the seed (4 to 6 on commissural side) and many scattered through the thick corky pericarp, which also contains 5 small bundles of strengthening cells: seed-section variable, oval or much flattened (figs. 25, 26).—Perennial, mostly glabrous herbs, with twice pinnate leaves (upper opposite and 3-cleft), segments cuneate and incised, no involucre, narrow involucels, and bright yellow flowers in May.

1. **P. Nuttallii** DC. Mem. Umbel. 53. t. 13. Plant 2 to 3 feet high: pedicels and involucels pubescent.—Michigan to Louisiana and westward.

EXPLANATION OF PLATE II.—Fig. 14, Fruit of Angelica Curtissii, × 7. Fig. 15, Section of carpel of same, × 20. Fig. 16, Section of carpel of A. hirsuta, × 20. Fig. 17, Section of carpel of A. dentata, × 20. Fig. 18, Section of carpel of A. atropurpurea, × 20. Fig. 19, Fruit of Cœlopleurum Gmelini, × 7. Fig. 20, Section of carpel of same, × 20. Fig. 21, Fruit of Æthusa Cynapium, × 10. Fig. 22, Section of carpel of same, × 20. Fig. 23, Fruit of Conium maculatum, × 7. Fig. 24, Section of carpel of same × 20. Fig. 25, Fruit of Polytænia Nuttallii, × 3½. Fig. 26, Section of carpel of same, × 20.

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VOL. XII. NO. 4.—BOTANICAL GAZETTE.—APRIL, 1887.

Notes on Umbelliferæ of E. United States. III.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE III.)

The range of Erigenia bulbosa, as given on page 15, *ante*, should be somewhat extended, so as to include Eastern Pennsylvania, along the Lower Susquehanna (*Porter*), and Tennessee (*Gattinger*). It is very much desired that botanists will not only assist us in thus perfecting the range of our species of Umbelliferæ, but also in providing good fruiting specimens. The failure of many of our best collections in fruiting specimens is somewhat remarkable, and we give this early notice, that all collectors, western as well as eastern, may take pains during the coming season to collect fruiting specimens of all the Umbelliferæ of their region. We already have to acknowledge the courtesy which has extended to us all needed assistance from the Harvard Herbarium and from the herbaria of I. C. Martindale, Thomas C. Porter, M. S. Bebb, Wm. M. Canby, Walter Deane, and S. M. Tracy.

LIGUSTICUM L.—Fruit ovate to oblong, not flattened either way: carpel with 5 equal strong primary ribs (sometimes winged), each with a group of strengthening cells: oil-ducts 2–4 in the intervals, 6 on the commissural side: seed-section somewhat dorsally flattened: stylopodium conical (figs. 27–30).—Smooth perennials, with aromatic roots and fruit, 2–3 ternately compound leaves, and white flowers.

1 **L. Scoticum** L. Spec. 250. Stem simple, 1–2 ft. high: leaves twice ternate; leaflets ovate, coarsely toothed; fruit narrowly oblong, 4–5 lines long; oil-ducts small, 2–3 in the intervals; seed-section nearly semicircular (figs. 27, 28).—Salt marshes, New England. Fl. August.

2. **L. actæifolium** Michx. Fl. i. 166. Stem branched above, 2–6 ft. high: leaves thrice ternate; leaflets broadly oblong, coarsely serrate: fruit ovate, 2–3 lines long; oil-ducts large, 3–4 in the intervals; seed-section pentagonal (figs. 29, 30).—Rich ground, S. Pennsylvania to Kentucky and southward. Fl. July and August.

TIEDEMANNIA DC.—Fruit ovate to obovate, flattened dorsally: carpels with 5 primary equidistant ribs; dorsal and

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intermediate filiform; lateral extended into broad wings, closely contiguous to those of the other carpel, forming a winged margin to the fruit, nerved dorsally at the inner margin, giving the appearance of five filiform ribs on the back of each carpel; strengthening cells under each rib and nerve: oil-ducts solitary in the intervals, 2–6 on the commissural side: seed-section oblong to broadly oval: stylopodium short, thick, conical (figs. 31–36).—Smooth erect aquatic herbs, with leaves reduced to petioles or of few narrow leaflets, involucre and involucels present, and white flowers. Eastern species. Including *Archemora* DC.—Bentham and Hooker have included both Tiedemannia and Archemora under Peucedanum. They are very distinct in habit from our own Peucedanums, which are low dry ground western forms, with much dissected leaves and mostly yellow flowers. The fruit characters still further confirm this difference of habit, the carpels being much more flattened dorsally in Peucedanum, giving a narrow seed-section, the lateral wings nerved ventrally (on commissural side) instead of dorsally, thus giving the appearance of but 3 filiform ribs on the back of each carpel, the stylopodium depressed or wanting instead of conical, and no involucre. These characters seem sufficient not only to separate Tiedemannia and Archemora from Peucedanum, but to unite them into a single genus. No fruit character can be made to separate them, and the only distinction would have to be drawn from the leaves, and this breaks down in the intermediate Archemora ternata. So many salient characters unite Tiedemannia and Archemora, and so few can be made to separate them, that it seems best to consider them a single genus, and one well distinguished from Peucedanum, at least in North America. Archemora Fendleri of the south-west is probably not a member of the genus.

1. **T. teretifolia** DC. Mem. Umbel. 51, t. 12. Stem hollow, 2–6 feet high: leaves reduced to cylindrical hollow pointed nodose petioles: oil-ducts filling the intervals, 2–4 on commissural side (figs. 31, 32).—Virginia to Florida and Louisiana. Fl. August to September.

2. **T. ternata.** Stem slender, 2 feet high: leaves ternate, with linear entire leaflets, the lower long petioled, or sometimes reduced to a flat-tipped petiole: oil-ducts smaller, 4 on commissural side (figs. 33, 34). *Archemora ternata* Nutt. —North Carolina to Florida. Fl. November.

3. **T. rigida.** Stem 2–5 feet high: leaves simply pinnate, with 3–9 linear to lanceolate entire or remotely toothed leaflets:

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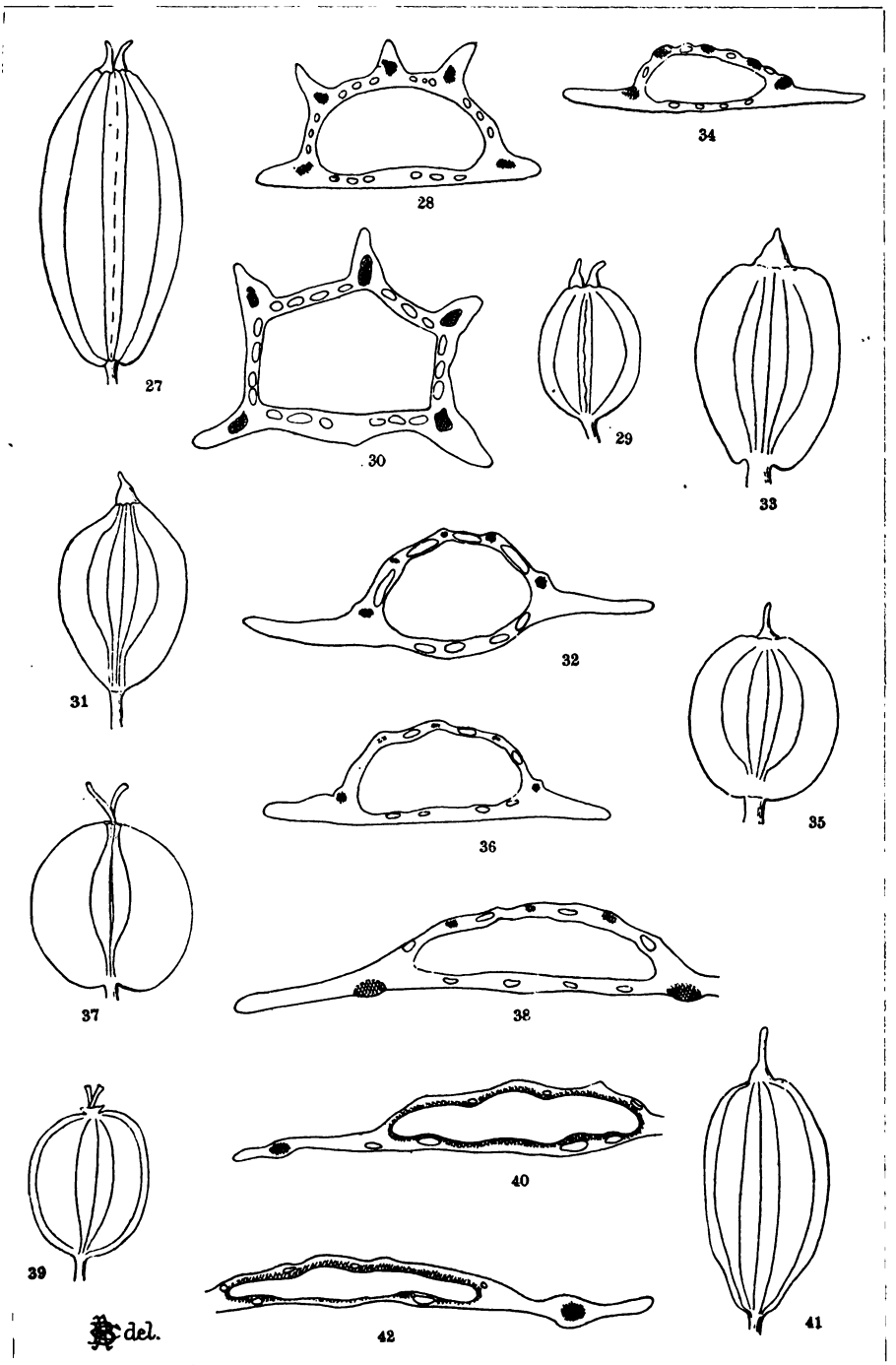

COULTER and ROSE on UMBELLIFERÆ.

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oil-ducts small or sometimes large, 4–6 on commissural side (figs. 35, 36) *Archemora rigida* DC.—New York to Minnesota and south to the Gulf. Fl. August.

PEUCEDANUM L.—Fruit roundish to oblong, much flattened dorsally: carpels with 5 primary ribs; dorsal and intermediate filiform and approximate; lateral extended into broad wings, closely contiguous to those of the other carpel so as to form a winged margin to the fruit, strongly nerved ventrally (on commissural side) at the inner margin; strengthening cells under each rib and nerve: oil-ducts 1–3 in the intervals, 2–6 on the commissural side: seed-section much flattened (figs. 37, 38).—Dry ground acaulescent (or short caulescent) herbs, with fusiform roots, dissected leaves, no involucre, mostly yellow (sometimes white) flowers, and stylopodium depressed or wanting. Western species.—The strong nerve on the commissural face of the lateral wings seems to be a constant and distinctive character, taking the place of the dorsally placed nerve on the lateral wings of Tiedemannia.

1. **P. nudicaule** Nutt. Torr. & Gray, Fl. i. 627. Low, nearly acaulescent, pubescent: leaves much dissected: flowers white: fruit nearly round, 2–3 lines broad; oil-ducts small, solitary in the intervals, 2–4 on the commissural side.—Minnesota to Iowa and westward. Fl. in earliest spring.

PASTINACA L.—Fruit oval, very much flattened dorsally: carpels with 5 primary ribs; dorsal and intermediate filiform; lateral extended into broad wings contiguous to those of the other carpel, strongly nerved towards the outer margin; strengthening cells continuous about the seed cavity and under the nerves: oil-ducts small, solitary in the intervals, 2–4 on the commissural side: seed-section very much flattened: stylopodium depressed (figs. 39, 40).—Tall stout biennial, with pinnately compound leaves, mostly no involucre, and yellow flowers.

1. **P. sativa** L. Stem grooved: leaflets ovate to oblong, cut-toothed.—Introduced everywhere. Fl. July–September.

Bentham and Hooker include Pastinaca under Peucedanum, although the fruit characters are quite distinct and almost identical with those of Heracleum. In fact, were it not for the remarkable petals of Heracleum and its conical stylopodium Pastinaca could not be distinguished from it. In comparison with Pencedanum the fruit of Pastinaca is

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much more dorsally flattened, the lateral wings are strongly nerved towards the outer margin, instead of at the inner margin on the commissural side, and a remarkable layer of strengthening cells completely invests the seed cavity, instead of occurring in small isolated groups beneath each rib, all of which characters are shared with Heracleum. As of minor importance the habit of Pastinaca is not that of Peucedanum, but rather that of Heracleum. Pastinaca is thus characterized by the fruit and habit of Heracleum and the floral character of Peucedanum, and had better stand as an intermediate genus. The length of the oil-ducts, a character sometimes used, is far from constant. In Peucedanum they are generally as long as the fruit; in Pastinaca sometimes as long and sometimes shorter; in Heracleum generally about half as long, though sometimes nearly as long.

HERACLEUM L.—Fruit oval, somewhat narrowed at base: like *Pastinaca*, but with thick conical stylopodium (figs. 41, 42).—Tall stout perennial, with ternately compound leaves, deciduous involucre, white flowers, and obcordate petals, the outer ones commonly larger and 2-cleft.

1. **H. lanatum** Michx. Fl. i. 166. Woolly, stem grooved: leaflets broad, irregularly cut-toothed.—Wet ground, throughout the northern states, and as far south as North Carolina and Kentucky; also westward. Fl. June.

EXPLANATION OF PLATE III.—Figures 27, 29, 37, 39, 41, are $\times 4$; figures 31, 33, 35, are $\times 6\frac{1}{2}$; all cross-sections are $\times 20$.

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From the BOTANICAL GAZETTE, Vol. xii, No. 5.]

Notes on Umbelliferæ of E. United States. IV.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE IV.)

HYDROCOTYLE Tourn.—Fruit (and carpels) strongly flattened laterally, more or less orbicular: carpel with 5 primary ribs (additional secondary ones with reticulations in a single species); dorsal ribs marginal, broad or filiform; intermediate ribs filiform (rarely obsolete), usually curved; lateral ribs filiform or broad, distinct or confluent: a prominent oil-bearing layer beneath the epidermis (except in H. Americana), occasionally containing small oil ducts[1]: a thick layer of strengthening cells surrounding the seed cavity (except in H. ranunculoides) (figs. 43-56).—Low herbaceous perennials, growing in or near water, with slender creeping stems, orbicular-peltate or reniform leaves, and small white flowers in simple or proliferous umbels. Flowering all summer. In figure 44, *a* indicates the oil-bearing layer, *b* ordinary parenchyma, *c* the layer of strengthening cells.

* Fruit with pericarp thin except at the broad thick corky dorsal and lateral ribs (figures 43–50): leaves orbicular-peltate, crenate: peduncles as long as petioles, all from slender creeping rootstocks.

+ Fruit notched[2] at base and apex; intermediate ribs corky (figures 43–48).

1. **H. umbellata** L. Spec. 234. Umbels many-flowered, simple (sometimes proliferous): pedicels 2 to 6 lines long: fruit about 1½ lines broad, strongly notched (figs. 43, 44).—Massachusetts to Minnesota and southward to the Gulf.

2. **H. prolifera** Kellogg, Proc. Calif. Acad. i. 15. Umbels mostly proliferous, with 5 to 20-flowered whorls: pedicels 1 to 3 lines long: fruit about a line broad, but slightly notched (figs. 45, 46).—Texas, to Arizona and California. This species is too near H. umbellata. In the great majority of specimens they can be distinguished easily, but the occasional forms of H. prolifera which are not proliferous, and

[1] This character of a prominent oil-bearing layer differs from any other group yet studied. In the European H. vulgaris the oil-bearing layer breaks through the epidermis in places covering the fruit with oil vesicles.

[2] This notching may not be apparent except in fully matured fruit.

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with many flowers and long pedicels, can be distinguished with difficulty. The fruit sections are but slightly different. If this is a good species, the following is a better one.

3. **H. Canbyi.** Umbels 3 to 9-flowered, generally proliferous: pedicels very short, but distinct: fruit about 2 lines broad; carpels broader and more flattened than in the preceding forms, sharper margined, dorsal and lateral ribs much more prominent; seed-section much narrower (figs. 47, 48). *H. umbellata* var? *ambigua* Gray, Manual, 190.—New Jersey to Maryland. It would be proper to call this species H. ambigua, but that name already has a place among the synonyms of Erigenia bulbosa.

The three foregoing species, with H. vulgaris of Europe, form a very natural group, closely resembling each other in the anatomical details of the fruit. H. vulgaris is most nearly related in external appearance to H. Canbyi, but differs in its smaller fruit more or less dotted with oil vesicles, its less flattened carpels, and less prominent dorsal and lateral ribs, thus intermediating between H. Canbyi and the first two species. There can be no doubt but that our three species are the North American representatives of H. vulgaris.

++Fruit not notched; intermediate ribs not corky (figs. 49, 50).

4. **H. interrupta** Muhl. Cat. 10. Umbels few-flowered, proliferous, forming an interrupted spike: pedicels very short or none: fruit 1½ to 2 lines broad; dorsal and lateral ribs very prominent (figs. 49, 50).—Massachusetts to Florida and Texas; also in Utah.

* * Fruit with pericarp uniformly corky thickened and ribs all filiform (figs. 51-56): leaves not peltate: peduncles much shorter than petioles.

+Fruit small (¾ to 1½ lines broad), without secondary ribs or reticulations: involucral bracts small or wanting.

5. **H. Americana** L. Spec. 234. Stems filiform, branching and creeping: leaves thin, round-reniform, crenate-lobed and lobes crenate, shining: few-flowered umbels axillary and almost sessile: fruit less than a line broad; intermediate ribs prominent; no oil-bearing layer; seed-section broadly oval (figs. 51, 52).—Throughout the North and southward to North Carolina.

6. **H. ranunculoides** L. f. Suppl. 77. Usually floating: leaves thicker, round-reniform, 3 to 7-cleft lobes crenate: peduncles 1 to 3 inches long, reflexed in fruit: capitate umbel

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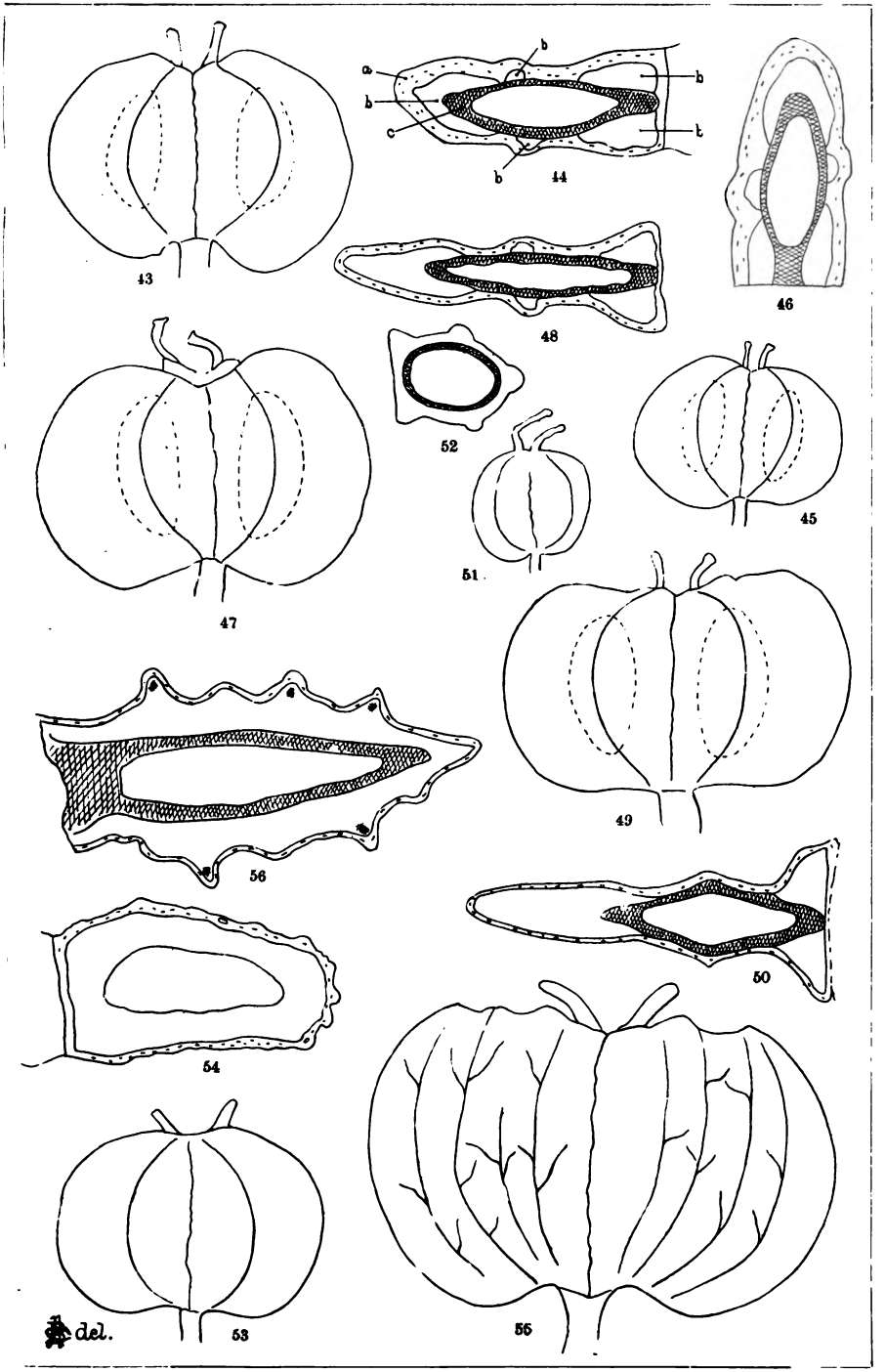

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5 to 10-flowered: fruit 1 to 1½ lines broad; ribs rather obscure; no layer of strengthening cells about seed cavity; seed-section oblong (figs. 53, 54).—E. Pennsylvania to Florida, thence westward to Texas and California.

++Fruit larger, with prominent secondary ribs and reticulations: the 2 to 4-flowered umbel subtended by an involucre of two conspicuous bracts.

7. **H. Asiatica** L. Spec. 234. Petioles and peduncles (1 to 2 inches long) clustered on creeping stems or runners: leaves ovate-cordate, repand-toothed, thickish: fruit about 2 lines broad · seed-section narrowly oblong (figs. 55, 56). *H. repanda* Pers., Benth in Fl. Austral. iii. 347.—Maryland to Florida and westward.

EXPLANATION OF PLATE IV.—All surface views are × 15; all transverse sections are × 27.

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[From the BOTANICAL GAZETTE, Vol. xii, No. 6.]

Notes on Umbelliferæ of E. United States. V.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE V.)

[In addition to the collections mentioned in the April GAZETTE, we have now to add those belonging to Brown University. Prof. W. W. Bailey has thus kindly put at our disposal, not only his own large collection of Umbelliferæ, but also those of Olney and Bennett.]

THASPIUM Nutt.—Fruit ovoid to oblong, slightly flattened dorsally: carpel with 5 primary ribs, 3 or 4 or all of them strongly winged: oil-ducts solitary in the intervals, two on the commissural side: seed-section round or somewhat dorsally flattened, indented beneath the oil-ducts: stylopodium wanting; styles long (figs. 57–62).—Perennials (2 to 5 ft. high), with ternately divided leaves and broad serrate or toothed leaflets (or lower leaves simple), mostly yellow flowers, and all the fruit pedicelled.--The species of Thaspium are in great confusion. In Gray's Manual *T. aureum* Nutt. and

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T. trifoliatum Gray each have an apterous variety. These apterous forms were taken from Koch's genus Zizia and placed under the Thaspium species apparently from the close resemblance of the foliage. The fruit characters, however, are abundantly distinct, for the Zizia forms have simply ribbed fruit flattened laterally, the central fruit of the umbellets sessile, and flower early in spring; while T. aureum and T. trifoliatum of the Manual have winged fruit flattened dorsally, central fruit pedicelled, and flower late in summer, maturing fruit in the fall. Bentham and Hooker have transferred these apterous Zizia forms to a section Zizia under Carum, from which genus they differ in the absence of stylopodia, central sessile fruit, more prominent ribs, and Thaspium-like foliage. The same authors seem to have made no disposition of T. aureum of the Manual, unless it went with the apterous variety, while the group of forms under *T. trifoliatum* Gray of the Manual has been taken as representing *T. cordatum* Torr. & Gray. For this latter species Bentham and Hooker seem to have had in mind only Gray's apterous variety, and so referred it to Carum § Zizia as one of the two species. In Watson's Bibliographical Index the synonym *Carum cordatum* Benth. & Hook., under T. trifoliatum, is correctly quoted, so far as literature is concerned, but apparently should be transferred to *T. trifoliatum*, var. *apterum* Gray, to express the real form Bentham and Hooker had in mind. This leaves the Manual forms T. aureum and T. trifoliatum with its var. atropurpureum unprovided for by these authors, the two apterous varieties only having been used to form the section Zizia under Carum. An explanation of this may be found in the fact that most of the herbarium specimens labeled Thaspium aureum and T. trifoliatum are really the so-called apterous varieties. The specific forms with winged fruit are quite uncommon among herbarium specimens, while the apterous forms are very abundant.

1. **T. aureum** Nutt. Genera, i. 196. Glabrous: root-leaves mostly cordate, serrate; stem-leaves simply ternate (rarely biternate); leaflets ovate to lanceolate, round or tapering at base, serrate: flowers deep yellow: fruit globose-ovoid, about 2 lines long, all the ribs equally winged (figs. 57, 58).—Thickets and woodlands, as far west as Illinois. Flowering in summer and maturing fruit in late summer or autumn. This species has a wide range of variation in the division and toothing of its leaves, but they are so inconstant that it seems impossible to found specific distinctions upon them.

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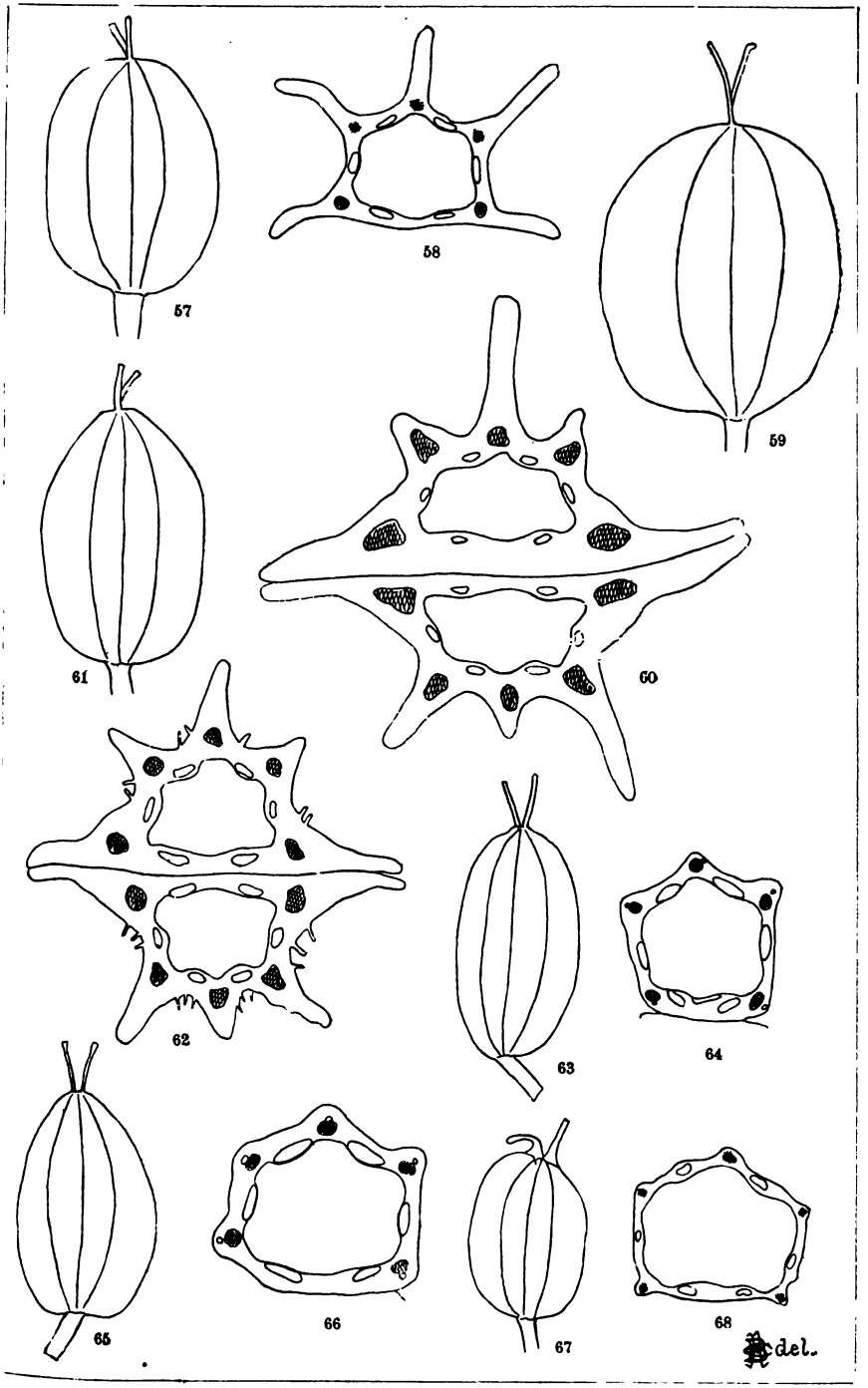

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In characterizing T. aureum, Nuttall has laid some stress upon "lateral divisions of the upper leaves subsessile," a character which means nothing, as these divisions may be sessile, subsessile, or petioled on the same plant, either in T. aureum or the T. trifoliatum of Gray. So far as foliage characters are concerned, serrate leaflets point to Nuttall's form, while crenately toothed leaflets stand for Gray's T. trifoliatum, exclusive of his vars. apterum and atropurpureum.

Further confusion in leaf characters has arisen by including the so-called apterous varieties, which we have transferred to Zizia. An extreme variation in leaf characters, but merging completely into the type through intermediate forms, is presented by

Var. **trifoliatum,** in which all the leaves or leaflets are crenate or crenately toothed. *T. trifoliatum* Gray, Manual, 195, in part.—Ohio to Illinois and westward to Oregon. This seems to be the common western form of the species, as our Pacific coast specimens are all distinctly var. trifoliatum. From Ohio to Illinois there is an interminable intermixing of the species and the variety, while in Pennsylvania the specific form is well represented.

Var. **atropurpureum.** Petals dark-purple. *T. atropurpureum* Nutt. *T. trifoliatum* var. *atropurpureum* Gray, Manual.—With the preceding forms. This variety has the leaf characters of the species, and if var. trifoliatum had been retained as a species, var. atropurpureum would have been transferred to T. aureum.

In giving the range of the above group of forms it has been impossible to use published ranges owing to the great confusion as to what forms were intended. Discarding the apterous varieties, the true Thaspiums of this group are but scantily represented in our herbaria, far more so, probably, than their occurrence would justify. The early spring and summer flowers and fruits of the apterous forms have probably too often satisfied collectors that they had already secured good material of forms which only appeared in collecting condition in late summer and autumn. Therefore we could only cite such range as our material indicated, confident at the same time that it could not represent the whole range. We would call the attention of collectors to this point, that the true range of T. aureum and its var. trifoliatum may be obtained.

2. **T. barbinode** Nutt. Genera, i. 196. Loosely branched, pubescent on the joints, sometimes puberulent in the umbels:

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leaves 1 to 3-ternate; leaflets ovate to lanceolate, acute, with cuneate base, coarsely cut-serrate, often ternately cleft or parted: flowers light yellow: fruit broadly oblong, about 3 lines long and 2 lines broad, with mostly 7 ribs prominently winged, the other three not at all winged or but slightly so (figs. 59, 60).—Banks of streams, New York to Minnesota and southward. Fl. May and June.

Var. **angustifolia** has narrower, more sharply cut leaflets, and is readily distinguished from the type.—Marion Co., Illinois *(Bebb)*, Westmoreland Co., Pennsylvania *(W. W. Bailey)*, Montgomery Co., Indiana *(Rose)*.

3. **T. Walteri** Shuttlew. Loosely branched, pubescent on the joints, puberulent on branchlets, umbels, and fruit, with fewer leaves: leaves 1 to 3-ternate; leaflets 1 to 2-pinnatifid, lobes linear or oblong, one or two leaves near the base often very large and long petioled (petioles sometimes a foot long): flowers light yellow: fruit oblong, 1½ to 2½ lines long and 1 to 1½ lines broad, all the ribs winged, generally three of them narrowly so (figs. 61, 62). *T. pinnatifidum* Gray, Manual. —Barrens and mountains, North Carolina to Kentucky.

ZIZIA[1] Koch.—Fruit ovate to oblong, flattened laterally: carpel with 5 primary ribs (not at all winged): oil-ducts large, solitary in the intervals, two on the commissural side, and a small one in each rib: seed-section round, indented beneath the oil-ducts: stylopodium wanting; styles long (figs. 63–66).—Smooth perennials (1 to 3 ft. high), with mostly Thaspium-like leaves, yellow flowers, and central fruit of each umbellet sessile (in ours). Flowers in early spring, in open prairies and upland meadows.

In separating the species of Zizia from the Thaspium aureum group we are very much indebted to Mr. M. S. Bebb, who has placed the careful observations of ten years at our disposal, and who is convinced that they are abundantly distinct. His field observations concerning their decided differences in habitat and time of blooming very strongly confirm the differences discovered in fruit structure.[2]

1. **Z. aurea** Koch, Umbel. 129. Radical leaves very long-petioled, all but the uppermost leaves 2–3-ternate; leaflets ovate to lanceolate, sharply serrate: rays 15 to 25, stout, 1 or

[1] It must be remembered that the Zizia of Gray's Manual is a Pimpinella.

[2] The western species that has been variously called Seseli Hallii, Musenium Greenei, and Carum (?) Hallii is evidently a Zizia. Its fruit characters are identical with those of Zizia, and had Koch's genus been retained it would probably have already included this species as Zizia Hallii.

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2 inches long: fruit oblong, about 2 lines long (figs. 63, 64). *Thaspium aureum* Nutt., var. *apterum* Gray, Manual, 195. *Carum aureum* Benth. & Hook. Gen. Pl. i. 891.—Throughout our range, extending westward as far as the Saskatchewan and Texas.—Although Thaspium aureum, var. apterum is the real synonym of this species, botanists will find in their herbaria many specimens of Zizia aurea labeled Thaspium aureum and Thaspium trifoliatum.

Var. **Bebbii.** A more slender, mountain form, with leaflets more coarsely serrate or even toothed, the radical leaves smaller and more simple: rays 2 to 8, slender, 2 or 3 inches long: fruit mostly smaller, oval, 1 to 1½ lines long.—Virginia and North Carolina. Collected by *Curtiss* (1868), *Canby* (1876), *Meehan*, *Porter*, *Leidy* and *Willcox* (1880).

2. **Z. cordata** Koch, Umbel. 129. Radical leaves mostly long-petioled, cordate or even rounder, crenately toothed, very rarely lobed or divided; stem-leaves simply ternate or quinate, ovate to lanceolate, simply serrate, incised, or even parted: fruit ovate, 1½ lines long; seed-section larger than inthe last (figs. 65, 66). *Thaspium trifoliatum*, var. *apterum* Gray, Manual, 195. *Carum cordatum* Benth. & Hook. Gen. Pl. i. 891.—Same range as last and extending to Oregon. As in the last species, herbarium specimens of Zizia cordata will be found labeled almost anything under the Thaspium aureum section.

CARUM L.—Fruit ovate to oblong, flattened laterally: carpel with 5 primary ribs: oil-ducts large, solitary in the intervals, 2 to 6 on the commissural side, none in the ribs: seed-section dorsally flattened, more or less indented beneath the oil-ducts: stylopodium conical (figs. 67, 68).—The American species are western, with tuberous or fusiform roots, simply pinnate leaves with linear leaflets, and white flowers. The common garden caraway from Europe seems to have become naturalized in many places, and is

1. **C. Carui** L., with pinnately compound leaves and filiform divisions.—Apparently more commonly naturalized to the north and northwest.

EXPLANATION OF PLATE V.—Fig. 57, fruit of Thaspium aureum; fig. 58, section of carpel of same; fig. 59, fruit of T. barbinode; fig. 60, section of fruit of same; fig. 61, fruit of T. Walteri; fig. 62, section of fruit of same; fig. 63, fruit of Zizia aurea; fig. 64, section of carpel of same; fig. 65, fruit of Z. cordata; fig. 66, section of carpel of same; fig. 67, fruit of Carum Carui; fig. 68, section of carpel of same. All surface views are × 7; transverse sections × 22.

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[From the BOTANICAL GAZETTE, Vol. xii, No. 7.]

Notes on Umbelliferæ of E. United States. VI.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE IX.)

PIMPINELLA Linn.—Fruit oblong to ovate, flattened laterally: carpel with 5 equal slender primary ribs (sometimes almost obsolete): oil-ducts 2-6 in the intervals, 4-8 on the commissural side: seed-section somewhat dorsally flattened, the face from slightly convex to more or less concave: stylopodium cushion-like or conical (figs. 69–74).—Glabrous perennials, with ternately or pinnately compound leaves, involucre and involucels scanty or none, and white or yellow flowers.[1]

1. **P. integerrima** Benth. & Hook. Gen. Pl. i. 894. Glaucous, 1-3 feet high, branching: leaves 2 to 3-ternately compound; leaflets lanceolate to ovate, entire: flowers yellow: fruit broadly oblong, 2 lines long; oil-ducts mostly 3 in the intervals, 4 on the commissural side: seed-face almost flat:

[1] Our two western species are:

P. apiodora Gray, of the Pacific slope, from Northern California and Nevada to Oregon, of which no good fruit has been collected, and the very distinct new species from Southern California,

P. Parishii. Smooth, erect, 1-2 ft. high, from a deep-seated fleshy root: radical and lower cauline leaves ternate, on petioles 2-4 in. long; leaflets linear-lanceolate, entire, 1-3 in. long, upper leaflet more or less distant; upper cauline leaves gradually reduced to bracts: peduncles 2-6 in. long; rays 8-10, glabrous; involucre of one or two bracts, or wanting; involucels of 2-6 linear bractlets: flowers white or pinkish: calyx-teeth prominent: fruit ovate to oblong, 1½-2 lines long; carpel with 5 slightly prominent equal ribs; oil-ducts 2-4 in the intervals, 6 on the commissural side: seed-face more or less concave: purple styles recurved in fruit, with conical stylopodia (figs. 73, 74).—Damp meadows, Bear Valley, San Bernardino Mts., California, August, 1882, *S. B. & W. F. Parish.* This is 987 Parish in part, and was detected in Mr. Martindale's collection. The original specimens under this number were collected in the San Jacinto Mts., in June, 1881, and were distributed as *Carum Gairdneri* Benth. & Hook., but are probably *C. Kelloggii* Gray. In 1882 specimens were collected in Bear Valley, San Bernardino Mts., and referred to the same number, and so distributed. All of this latter collection is the very distinct new species described above. Mr. Parish writes that the species is very abundant in Bear Valley, but is quite inaccessible, and that his specimens of it have mostly been distributed among European herbaria.

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stylopodium small or wanting (figs. 69, 70). *Zizia integerrima* DC.—Rocky hillsides throughout our range. Fl. May.

2. **P. Saxifraga** L. var. **major** Koch. Leaves simply pinnate, with sharply-toothed leaflets: fruit oblong, about a line long, ribs sometimes almost obsolete; oil-ducts 2-3 in the intervals, 4 on the commissural side: seed-face somewhat convex; stylopodium cushion-like (figs. 71, 72).—Along rocky shores of the Delaware river and roadsides near Easton, Pennsylvania, *Thos. C. Porter*. Fl. July to September. This European species has been collected by Prof. Porter since 1877, and is reported by him as well established.

EULOPHUS Nutt.[2]—Fruit ovate, flattened laterally: carpel with five equal slender primary ribs (sometimes very indistinct): oil-ducts large, almost contiguous, mostly 3 in the intervals, 4 on the commissural side: seed-section dorsally flattened, with concave face: stylopodium thick conical (figs. 75, 76). Glabrous perennial from fleshy fascicled roots, with ternately or pinnately compound leaves, involucre and involucels scanty or none, and white flowers.

1. **E. Americanus** Nutt. DC. Mem. Umbel. 69, t. 2. Branching, 3 to 5 feet high: radical and lower cauline leaves large, 1-2-pinnately compound, with leaflets cut into short narrow segments; upper cauline leaves ternate, with long linear entire segments: calyx-teeth prominent: fruit 2-3 lines long (figs. 75, 76).—Ohio to Illinois and Arkansas.

The close relationship between Pimpinella and Eulophus (as here defined) is very evident. The character of deeply sulcate seed apparently fails in E. Americanus, as testified by a very large collection of well-matured fruit from Mr. Bebb's herbarium, which apparently has also supplied many other herbaria. The fruit from the Harvard Herbarium is not perfectly mature, and hence the concave face in a few cases seems slightly sulcate, but the ordinary section of the mature seed is as shown in figure 76, with concave face much as in certain species of Pimpinella. In the western species there is a remarkably deep sulcation, but E. Americanus seems to be most unnaturally allied with them, not only in fruit characters, but in vegetative characters as well. How it is to be separated in generic characters from Pimpinella is what we have been unable to discover, but for the present we have retained the old name.

[2] This generic description is based on E. Americanus, as the western species (E. peucedanoides and E. Texanus) differ in certain important characters.

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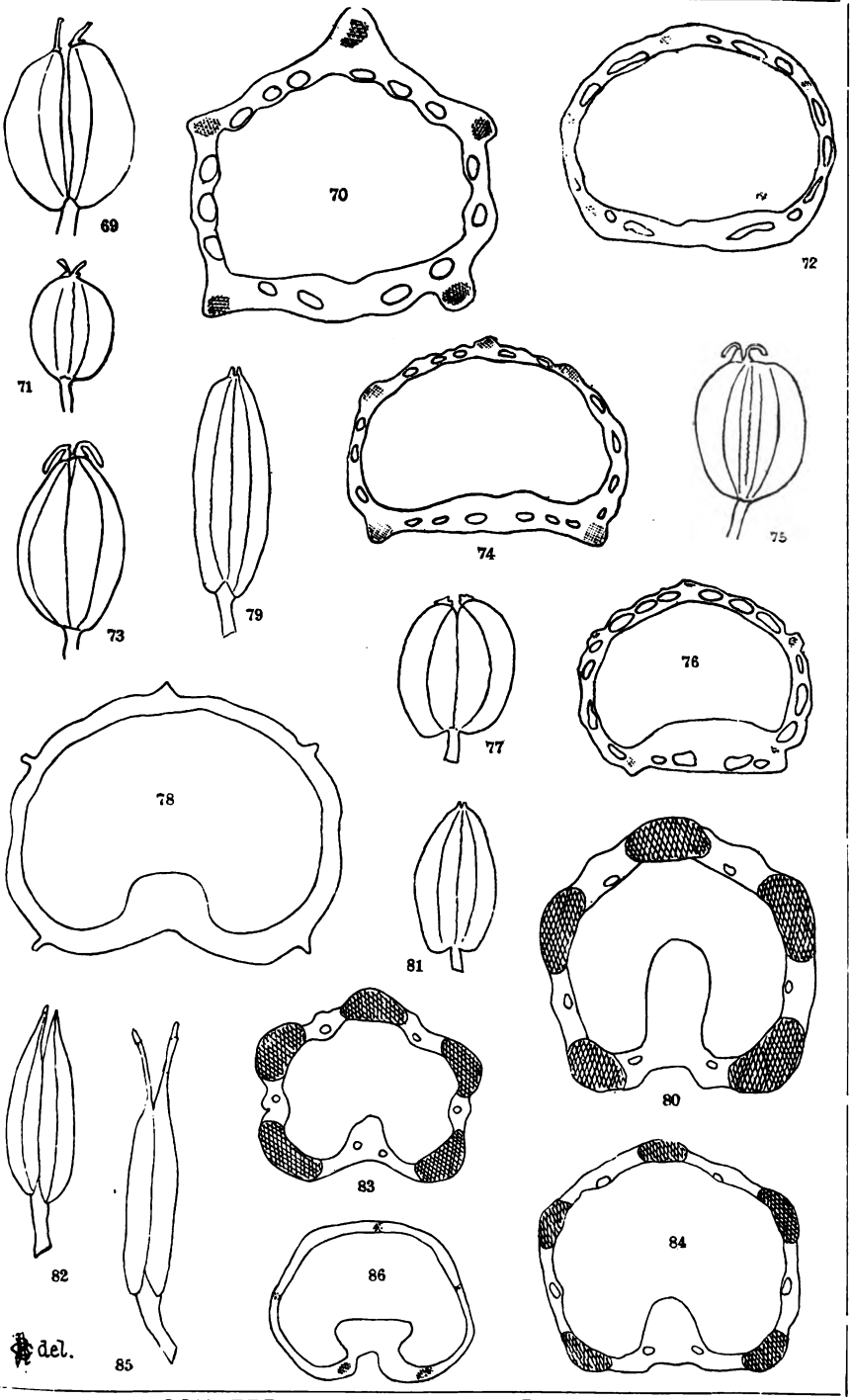

COULTER and ROSE on UMBELLIFERÆ.

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BUPLEURUM Linn.—Fruit oblong, flattened laterally: carpel with 5 equal very slender primary ribs: oil-ducts present or (in ours) wanting: seed-section dorsally flattened, with face broadly sulcate: stylopodium flat (figs. 77, 78). Plant with simple entire ovate perfoliate leaves, no involucre, involucels of 5 ovate leaflets, and yellow flowers.

1. **B. rotundifolium** L[3].—Introduced from Europe into fields and cultivated ground, New York to North Carolina and Tennessee.

CHÆROPHYLLUM Linn.—Fruit narrowly oblong to linear, notched at base, flattened laterally, with short beak or none: carpel with 5 equal primary ribs, each of which is subtended by a large group of strengthening cells usually occupying the whole thickness of the thick pericarp: oil-ducts small, mostly single in the intervals, two on the commissural side: seed with more or less deeply sulcate face: styles short (figs. 79–84).—Annuals in moist ground, with ternately decompound leaves, lobed or toothed leaflets, usually no involucre, many-leaved involucels, and white flowers.

1. **C. procumbens** Crantz, Umbel. 77. More or less hairy: stems slender, spreading, 6 to 18 inches high: fruit (in the type) narrowly oblong, glabrous, contracted but not tapering at the summit; intervals broader than the ribs: seed-face deeply sulcate (figs. 79, 80).—New Jersey to Iowa and southward to North Carolina and Mississippi. We consider this polymorphous species to include all our forms of Chærophyllum. The only characters that can be used to separate them specifically must be drawn from the beaking of the fruit, the size of the ribs, and the depth of the sulcus in the seed-face. Isolated specimens can be selected which seem distinct enough in these particulars, but a study of a great number of specimens from all regions shows an inextricable running together, and it seems impossible to draw specific lines. Characters that have been used to define species are found displayed on the same plant. Owing to intergrading forms even varieties can not in all cases be distinctly set apart, but the following extreme forms may, in most cases, be distinguished from the specific type by means of mature fruit:

Var. **Shortii** Torr. & Gray, Fl. 1. 637, has more broadly oblong to ovate fruit, not at all contracted at the summit (fig. 81; section as in fig. 80).—Kentucky to Louisiana.

[3] *B. protractum* Link, which differs from B. rotundifolium chiefly in its tuberculate fruit, has been collected on ballast ground by Mr. Martindale.

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Var. **Tainturieri** has fruit tapering at the summit or beaked, ribs very prominent and much broader than the intervals, and seed-face with a shallower sulcus (figs. 82, 83). *C. Tainturieri* Hook.—From Florida to Texas.

Var. **dasycarpum** differs from the preceding variety in having pubescent fruit, with ribs prominent but narrower than the intervals (fig. 84; surface outline as in fig. 82). *C. Tainturieri* var. *dasycarpum* Hook.—Texas. This is Hall's 260, "pubescent form," and Lindheimer's 616.

ANTHRISCUS Hoffm.[4]—Fruit linear, notched at base, flattened laterally, long beaked (in ours): carpel without ribs, but beak ribbed: thin pericarp with no strengthening cells nor oil-ducts: seed with sulcate face (figs. 85, 86).—Resembling Chærophyllum in vegetative characters.

1. **A. Cerefolium** Hoffm.—Mature fruit smooth and shining. *Chærophyllum sativum* L.—Naturalized in Eastern Pennsylvania, *Thos. C. Porter*.

EXPLANATION OF PLATE IX.—Fig. 69, fruit of Pimpinella integerrima; fig. 70, section of carpel of same; fig. 71, fruit of P. Saxifraga, var. major; fig. 72, section of carpel of same; fig. 73, fruit of P. Parishii; fig. 74, section of carpel of same; fig. 75, fruit of Eulophus Americanus; fig. 76, section of carpel of same; fig. 77, fruit of Bupleurum rotundifolium; fig. 78, section of carpel of same; fig. 79, fruit of Chærophyllum procumbens; fig. 80, section of carpel of same; fig. 81, fruit of C. procumbens, var. Shortii; fig. 82. fruit of C. procumbens var. Tainturieri; fig. 83, section of carpel of same; fig. 84, section of carpel of C. procumbens var. dasycarpum; fig 85, fruit of Anthriscus Cerefolium; fig. 86, section of carpel of same. Figs. 75, 79, 81, 82 are $\times 4$; figs 69, 71, 73, 77 are $\times 7$; fig. 76 is $\times 20$; figs. 70, 72, 74, 76, 78, 80, 83, 84 are $\times 36$.

[4] *A. sylvestris* Hoffm. has been collected by Mr. Martindale on ballast ground.

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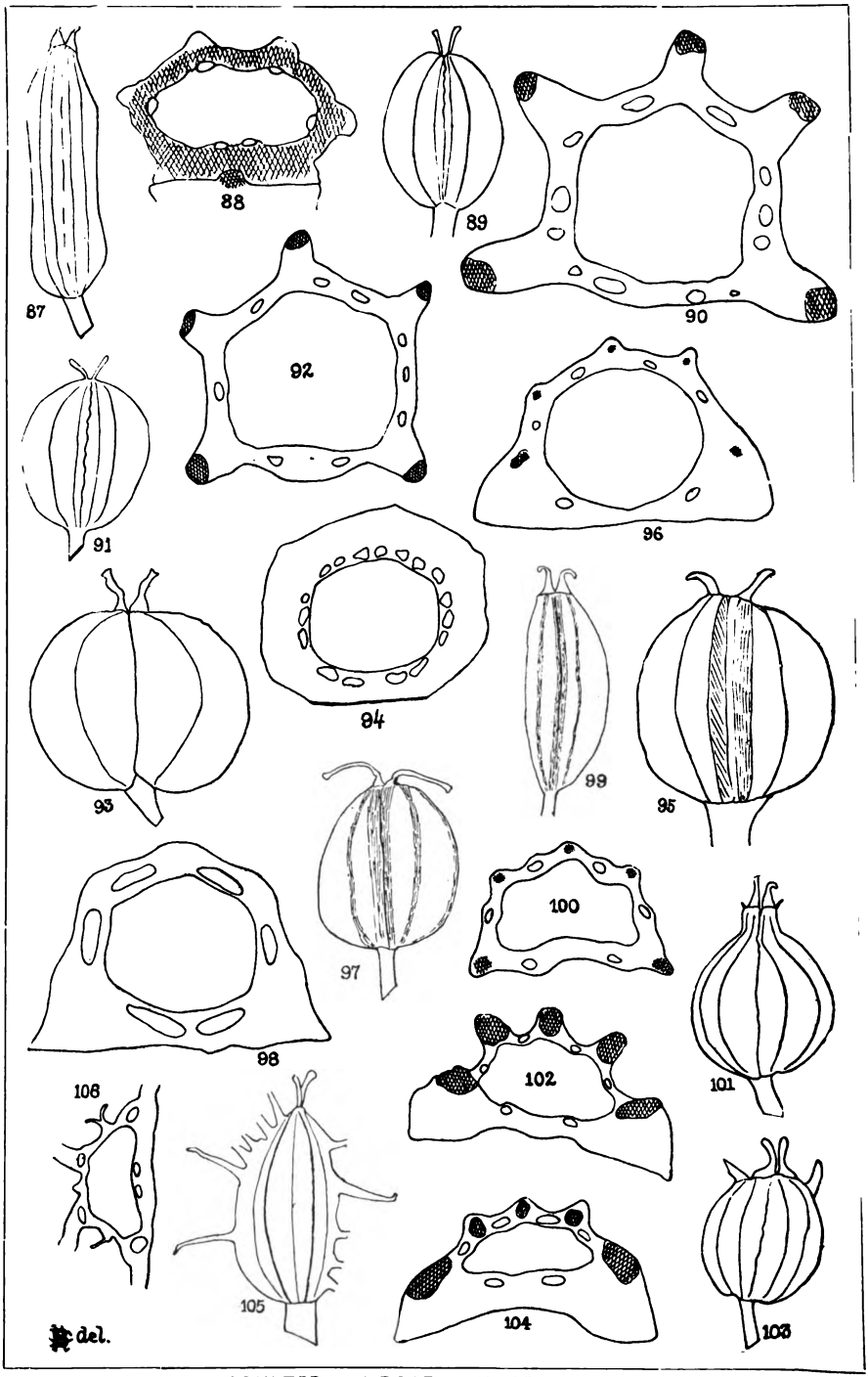

COULTER and ROSE on UMBELLIFERÆ.

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VOL. XII. NO. 11.—BOTANICAL GAZETTE.—NOV., 1887.

Notes on Umbelliferæ of E. United States. VII.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE XV.)

TREPOCARPUS Nutt.—Fruit linear-oblong, flattened laterally: carpel somewhat dorsally flattened, with the 5 primary ribs filiform or obsolete, the 4 secondary ones prominent: oil-ducts solitary under secondary ribs, two on commissural side: stylopodium conical, with very short style (figs. 87, 88).—Glabrous annuals, with thin pinnately decompound leaves and linear segments, lateral few-rayed umbels opposite the leaves, white flowers, and prominent calyx-teeth.

1. T. Æthusæ Nutt. DC. Mem. Umbel. 56, t. 14. From a few inches to three feet high: umbels 2 to 5-rayed; umbellets few-flowered: involucre and involucels of few linear bracts, entire or divided: fruit 4 to 5 lines long; pericarp wall thick and mostly made up of strengthening cells; secondary ribs corky.—From Arkansas to Louisiana, Indian Territory and Texas. Fl. July.

SIUM Linn.—Fruit ovate to oblong, flattened laterally: carpel with 5 corky primary ribs (each with a well-developed group of strengthening cells at tip): oil-ducts 1 to 3 in the intervals (never solitary in all the intervals), 2 to 6 on commissural side, near center of pericarp: seed-section roundish or sub-angular: stylopodium depressed or wanting, with short style (figs. 89–92).—Smooth perennials growing in water or wet places, with pinnate leaves and serrate or pinnatifid leaflets, involucre and involucels of several bracts, and white flowers, in summer.

Bentham and Hooker refer our two species of Sium to Apium, but to us they seem abundantly distinct, as also indicated by Watson, Bot. Calif. i. 261. The oil-ducts are never solitary in all the intervals, and the prominent group of strengthening cells in the outer edge of each rib still further emphasizes the distinction. There is no better defined generic group in Umbelliferæ than that formed by our

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two species of Sium, being so nearly identical in fruit and so easily separated from all other genera.

1. **S. cicutæfolium** Gmelin, Syst. 2. 482. Stout, 2 to 6 feet high: leaflets 3 to 8 pairs, linear to lanceolate, sharply serrate and acuminate, 2 to 5 inches long: fruit larger in section and with more prominent ribs than in the next; oil-ducts 2 to 6 on commissural side (figs. 89, 90). *S. lineare* Michx. *Apium lineare* Benth. & Hook.—Throughout our range, and west to the Pacific.

2. **S. Carsoni** Durand, Gray's Man. 196. Weak, 1 to 2 feet high: leaflets 1 to 3 pairs, linear, sharply serrate, 1 to 2 inches long; when submersed or floating, very thin, ovate to oblong, usually lacinate-toothed or dissected, the leaf sometimes reduced to the terminal leaflet: oil-ducts 2 to 4 on commissural side (figs. 91, 92). *Apium Carsoni* Benth. & Hook.—Pennsylvania, Connecticut, Rhode Island, and Massachusetts.

BERULA Koch.—Fruit nearly globose, somewhat flattened laterally, emarginate at base: carpel with 5 filiform primary ribs: pericarp thick and corky, with no strengthening cells: oil-ducts numerous and contiguous, closely surrounding the seed cavity: seed-section round: stylopodium conical (figs. 93, 94).—Smooth aquatic perennial, with pinnate leaves and variously cut leaflets, and white flowers, in summer.

1. **B. angustifolia** Koch, Deutsch. Fl. 2.455. Stout, ½ to 3 feet high: leaflets 5 to 8 pairs, linear to oblong or ovate, serrate to cut-toothed, sometimes crenate: fruit ¾ line long. *Sium angustifolium* L.—Throughout our range and westward.

CRANTZIA Nutt.—Fruit globose, slightly flattened laterally: carpel with 5 primary ribs, each subtended by a small group of strengthening cells; the laterals thick and corky; the others filiform: oil-ducts solitary in the intervals, two on the commissural side: seed-section round (figs. 95, 96).—Small perennials, creeping and rooting in the mud, with hollow cylindrical or awl-shaped nodose petioles in place of leaves, simple few-flowered umbels, and white flowers. July.

1. **C. lineata** Nutt. Genera, 1. 178. Leaves very obtuse, 1 to 3 inches long, 1 to 2 lines broad: fruit a line long, the thick lateral wings forming a corky margin.—In brackish marshes along the coast, from Massachusetts to Mississippi.

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CICUTA Linn.—Fruit ovoid to oblong, slightly flattened laterally: carpel with 5 strong flattish corky primary ribs (laterals somewhat larger): oil-ducts solitary in the intervals, two on the commissural side: stylopodium conical or depressed (figs. 97–100).—Smooth poisonous marsh perennials, with pinnately or ternately compound leaves, and white flowers, in summer.

Bentham and Hooker, in Gen. Plant. i. 889, say "stylopodia crassiuscula, depressa, integra;" and Sereno Watson, in Bot. Calif. 1.260, says "stylopodium depressed." While this is apparently true in most specimens of mature fruit, in many younger specimens, and some mature ones, the stylopodium will be found to be conical. In any event it is large and prominent, and may or may not become conical. When depressed, we have not found it entire.

1. **C. maculata** L. Spec. 256. Stout, 2 to 6 feet high, stem streaked with purple: leaflets oblong-lanceolate (narrower above), coarsely serrate: fruit oval, 2 lines long, with no strengthening cells and large oil-ducts; seed-section roundish (figs. 97, 98).—Throughout our range and westward.

2. **C. bulbifera** L. Spec. 255. More slender, 1 to 3 feet high: leaflets linear, sparsely toothed; upper axils bearing clustered bulblets: fruit (seldom matured) oblong, 2 lines long, with groups of strengthening cells beneath the ribs and smaller oil-ducts; seed-section somewhat dorsally flattened. —Common northward.

CYNOSCIADIUM DC.—Fruit ovoid, not flattened either way: carpel with 5 strong primary ribs, lateral ones much the larger, forming a broad corky margin, a large group of strengthening cells in each rib: oil-ducts solitary in the intervals, two on the commissural side: seed-section somewhat flattened dorsally: stylopodium conical (figs. 101–104). —Glabrous annuals, with pinnately divided cauline leaves (leaflets linear), mostly undivided lower and radical leaves, white flowers, and persistent calyx-teeth.

1. **C. digitatum** DC. Mem. Umbel. 44 t. 11. Slender, 1 to 2 feet high: radical leaves linear-lanceolate, entire; cauline leaves palmately 3 to 5-parted: fruit a line long, contracted into a neck at summit, with very prominent ribs and minute calyx-teeth (figs. 101, 102).—Wet ground, Arkansas, Alabama, Louisiana and Texas. Fl. May, June.

2. **C. pinnatum** DC. l. c. Smaller (in var. *pumilum* Eng. sometimes becoming cespitose): cauline leaves pinnately

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divided into few distant segments, terminal one much the largest; radical leaves similar, or often entire: fruit 1½ lines long, not beaked at summit, with less prominent ribs and very prominent calyx-teeth (figs. 103, 104).—Wet ground, Arkansas, Indian Territory and Texas. Fl. April.

DAUCUS Linn.—Fruit oblong, flattened dorsally: carpel with 5 slender bristly primary ribs and 4 winged secondary ones, each bearing a single row of prominent barbed prickles: oil-ducts solitary in the intervals (that is, under the secondary ribs), two on the commissural side: seed-section dorsally flattened, the face somewhat concave or almost plane (figs. 105, 106).—Bristly annuals or biennials, with pinnately decompound leaves, foliaceous and cleft involucral bracts, concave umbels (connivent in fruit), and white flowers.

1. **D. Carota** L. Stem bristly: ultimate segments of the leaf lanceolate and cuspidate: rays more numerous and elongated than in the next (figs. 105, 106).—Naturalized everywhere.

2. **D. pusillus** Michx. Fl. 1.164. Stems retrosely papillate-hispid: leaves more finely divided, the ultimate segments narrowly linear: umbels smaller, with fewer and shorter rays.—Throughout the southern states and westward.

The varieties microphyllus and scaber simply depend upon the varying character of the hairs, a character not to be relied upon. This species is a very close American representative of the European D. Carota, and it is really questionable whether they should be kept specifically apart. The fruit is so exactly similar in both species that it can not be distinguished, and hence our figures 105 and 106 represent D. pusillus just as well as D. Carota.

EXPLANATION OF PLATE XV.—Fig. 87, fruit of Trepocarpus Æthusæ; fig. 88, section of carpel of same; fig. 89, fruit of Sium cicutæfolium; fig. 90, section of carpel of same; fig. 91, fruit of S. Carsoni; fig. 92, section of carpel of same; fig. 93, fruit of Berula angustifolia; fig. 94, section of carpel of same; fig. 95, fruit of Crantzia lineata; fig. 96, section of carpel of same; fig. 97, fruit of Cicuta maculata; fig. 98, section of carpel of same; fig. 99, fruit of C. bulbifera; fig. 100, section of carpel of same; fig. 101, fruit of Cynosciadium digitatum; fig. 102, section of carpel of same; fig. 103, fruit of C. pinnatum; fig. 104, section of carpel of same; fig. 105, fruit of Daucus Carota; fig. 106, section of carpel of same. Fig. 87, is × 5; figs. 89, 91, 97, 99, 101, 103, 105 are × 8; figs. 88, 93, 95, 98, 100, 102, 104, 106 are × 25; figs. 90, 92, 94, 96 are × 40.

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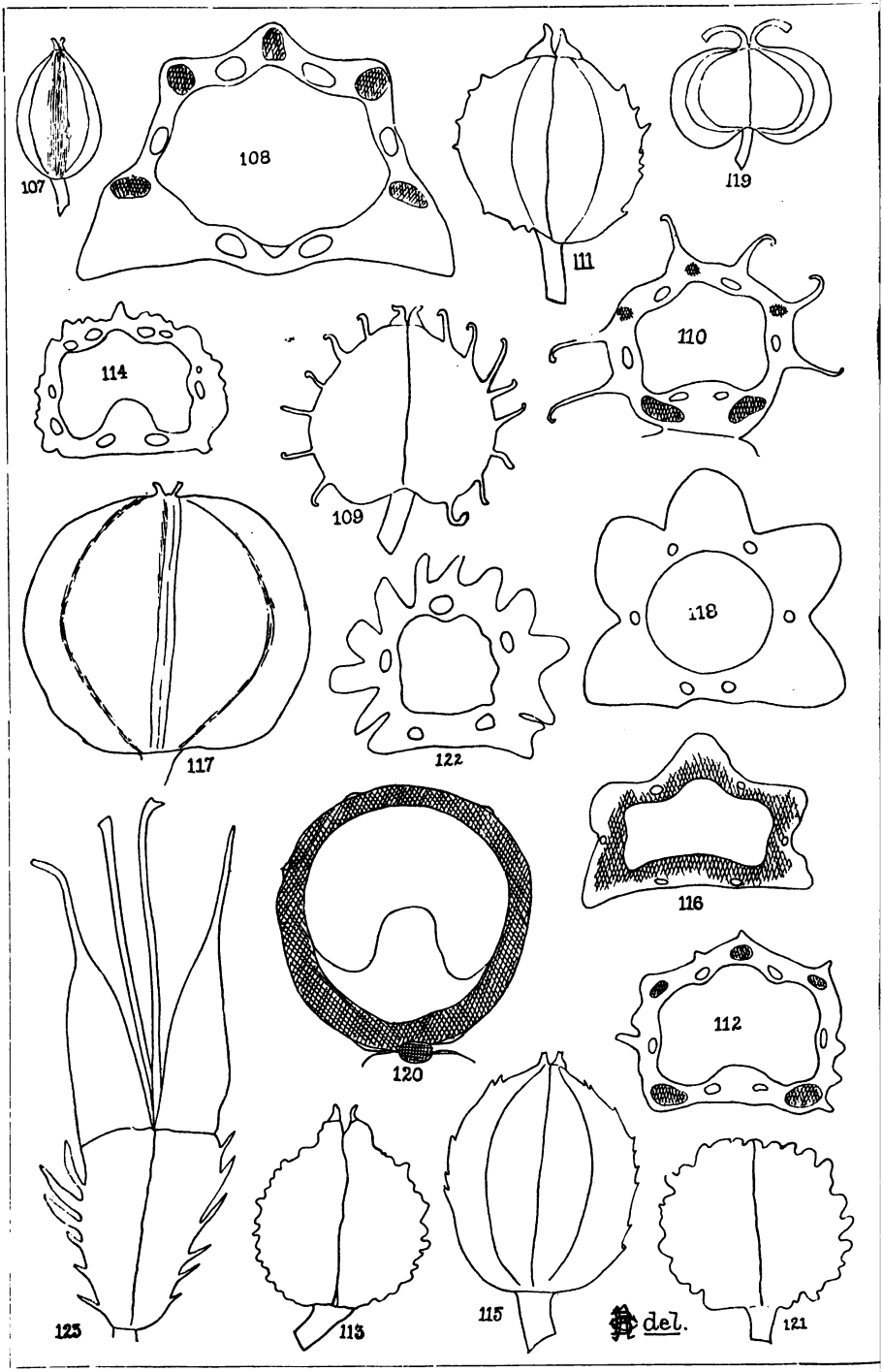

COULTER and ROSE on UMBELLIFERÆ.

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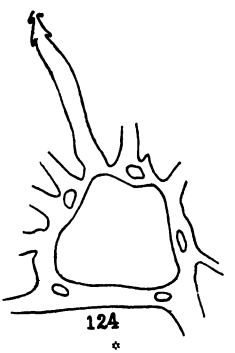
From the BOTANICAL GAZETTE, Vol. xii, No. 12.]

Notes on Umbelliferæ of E. United States. VIII.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE XVII.)

DISCOPLEURA DC. Fruit ovate, flattened laterally: carpel with 5 primary ribs subtended by strengthening cells; dorsal and intermediates prominent and rather acute; laterals broad and united with a thickened corky margin: oil-ducts solitary in the intervals, two on the commissural side: seed-section roundish (figs. 107, 108).—Smooth branching annuals, with finely dissected leaves (filiform divisions), and white flowers. Fl. June to October.



1. **D. capillacea** DC. Mem. Umbel. 38. t. 8. Umbels 5 to 20-rayed; involucral leaves (filiform) usually cleft or parted;

[8] Loc. cit. 72.
[9] All of the bees are females.
[*] Section of carpel of Eryngium diffusum X 40.

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involucels more or less prominent.—Wet ground, Massachusetts to Florida, and westward to the plains. Runs through many intermediate forms into the

Var. **Nuttallii,** with umbels 15 to 30-rayed, involucral leaves usually entire, and involucels minute (*D. Nuttallii* DC.).—In the lower Mississippi Valley.

Although var. Nuttallii is set apart as a variety, it must be understood to include only extreme forms. There are many forms which intermediate and combine the characters of the species and variety. The number of rays is very inconstant, while the involucral leaves are frequently cleft and entire in different umbels on the same plant, and the involucels may be as prominent in forms which are var. Nuttallii in every other respect, as in true D. capillacea, or they may be very minute in the species itself. Fruit characters entirely fail to give any distinction. As for the form called *D. capillacea*, var. *costata* DC., we are at a loss to discover even any varietal characters. In a large series of specimens so labeled from different herbaria we fail to find the slightest distinction from D. capillacea; and if there is a var. costata we have never seen it, nor is it known to our best collectors.

The two following genera have been referred to *Apium* L.: *Leptocaulis* by Bentham and Hooker, and *Ammoselinum* by Gray. The general habit of the plants and the size of the fruit may indicate some such common relationship, but a study of their fruit structure reveals differences fully as great as obtain among other genera of Umbelliferæ as at present considered. In fact, a glance at the figures representing these two genera and Apium on plate xvii will show a diversity of fruit characters greater than exists among any other three allied genera we have figured. Including these three genera under one would be entirely inconsistent with the definition of other genera of Umbelliferæ. We therefore restore the genera as follows:

LEPTOCAULIS Nutt.—Fruit ovate, flattened laterally, bristly or tuberculate: carpel with 5 primary ribs somewhat prominent or obsolete, each subtended by a prominent group of strengthening cells (except in L. patens): oil-ducts solitary in the intervals (except occasionally in L. patens), two on the commissural side: seed-section dorsally flattened, with face more or less concave: stylopodium conical (figs. 109–114).—Very slender smooth branching annuals, with

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finely dissected leaves (filiform or linear segments), and white flowers.

1. **L. echinatus** Nutt. DC. Prodr. 4. 107. A span to a foot high: fruit about half line long, echinate with spreading hooked bristles; ribs obsolete and seed-face slightly concave (figs. 109, 110). *Apium echinatum* Benth. & Hook.—Alabama to Arkansas and westward.

2. **L. divaricatus** DC. Mem. Umbel. 39. t. 10. One to two feet high, with spreading branches: umbels more diffuse than in the last, and usually with fewer rays: fruit half a line long, tuberculate; ribs somewhat prominent and seed-face slightly concave (figs. 111, 112). *Apium divaricatum* Benth. & Hook.—North Carolina to Florida and westward to Texas.

3. **L. patens** Nutt. DC. Prodr. 4. 107. One to two feet high, branching above: fruit half a line long, tuberculate; ribs obsolete and seed-face decidedly concave; pericarp thinner than in the preceding species and without strengthening cells; oil-ducts in the intervals often accompanied by smaller accessory ones (figs. 113, 114). *Apium patens* Watson, Bibl. Index, Polypet. 413.—From Missouri to Louisiana and Texas. This species, while undoubtedly most closely related to Leptocaulis, is exceptional in certain important characters. The thinner pericarp, the entire absence of strengthening cells, the frequent increase in the number of oil-ducts, and the almost sulcate seed-face are all characters that do not belong to Leptocaulis. While, therefore, we include it under this genus, it must be considered as an outlying member.

AMMOSELINUM Torr. & Gray.—Fruit ovate, flattened laterally: carpel with 5 prominent equal more or less scabrous ribs, the laterals closely contiguous to those of the other carpel, forming apparently a single rib: pericarp exceedingly hard, composed almost entirely of strengthening cells: oil-ducts solitary in the intervals, two on the commissural side, rather small and not close to seed cavity: seed-section dorsally flattened, with face slightly concave: stylopodium conical, with very short style (figs. 115, 116).—Low diffuse annual, with ternately divided leaves, the small ultimate segments linear to spatulate, and white flowers in small sessile or short-pedunculate unequal-rayed umbels.—This is one of the best marked genera of Umbelliferæ. Its affinities are doubtful, but it holds no relation whatever to Chærophyllum, as was surmised in the original description, followed by Bentham and Hooker.

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1. **A. Popei** Torr. & Gray, Pacif. R. Rep. 2. 165. About a span high, angles, midribs, rays, pedicels, and ribs of fruit rough scabrous: leaf-segments narrowly linear: fruit ovate-oblong, 2 to 2½ lines long, with thick corky commissure. *Apium Popei* Gray.—Texas *(Wright, Parry, Reverchon).* Fl. April, May.

2. **A. Butleri.** Smaller, nearly glabrous: leaf-segments narrowly oblong or spatulate: fruit ovate, about a line long, with ribs smooth or minutely scabrous, and corky commissure much less prominent (figs. 115, 116). *Apium Butleri* Eng. Proc. Am. Acad. xxi. 453.—Texas *(Hall, Reverchon, Joor);* Indian Territory *(Butler).* Fl. March, April. Distributed in various collections as Apium Popei.

APIUM Linn.—Fruit ovate or broader than long, flattened laterally: carpel with 5 prominent obtuse corky nearly equal ribs: pericarp with no strengthening cells: oil-ducts solitary in the narrow intervals, two on the commissural side: seed-section round: stylopodium depressed or wanting (figs. 117, 118).—Erect or prostrate herbs, with pinnately or ternately divided leaves, umbels opposite the leaves, and white flowers.

1. **A. leptophyllum** F. Muel., Benth. Fl. Austral. 3. 372. A few inches to two feet high: leaves ternately divided into filiform segments: umbels sessile or short-pedunculate: fruit a line long. *Helosciadium leptophyllum* DC.—Florida to Texas and westward. March to June.

A. nodiflorum Benth. & Hook. (*Helosciadium nodiflorum* Koch), an introduced species, reported first by Walter around Charleston, S. C., and not afterwards found, has been recently collected by Dr. J. H. Mellichamp. It is also found on the ballast grounds near Philadelphia by I. C. Martindale.

BIFORA Hoffm.—Fruit broader than long, flattened laterally, the two globose carpels connected only by a narrow commissure: carpel with primary ribs obsolete, and 4 filiform secondary ribs: pericarp thin and very hard, made up almost entirely of strengthening cells: oil-ducts none: seed-face deeply concave: stylopodium conical: styles recurved over the carpels (figs. 119, 120).—Slender smooth annuals, with pinnately dissected leaves (segments filiform), and white flowers in few-rayed umbels.

1. **B. Americana** Benth. & Hook. Gen. Pl. 1. 926. A foot or more high, branching above, rays and angles of stem (es-

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pecially summit of internodes) roughened with minute callous points: fruit 1½ lines long, 2½ lines broad. *Atrema Americana* DC.—Missouri *(Tracy)*, Arkansas and Texas.

ERYNGIUM Linn.—Fruit ovate or obovate, flattened laterally, scaly, tuberculate or bristly: carpel with ribs obsolete (in ours): pericarp without strengthening cells: oil-ducts solitary beneath the ribs (or their normal position), two on the commissural side (making 5 in all): seed-face plane: styles filiform (figs. 121–124).—Herbs with spiny or prickly mostly lobed or toothed leaves, and bracted flowers closely sessile in dense heads.—A large genus, with about 20 North American species, chiefly southern. The genus is so well defined by its general habit, and mature fruit is so completely lacking in our herbaria, that in the present series of papers we will not undertake to define the species. We would urge upon collectors the necessity of securing good fruiting specimens of all our Eryngiums, as in the few species studied there is indicated a wide range of fruit structure.

With this paper is concluded the presentation of our 80 species of Umbelliferæ east of the 100th meridian. It is to be hoped that the characters presented will be subjected to a thorough test by collectors and herbarium workers, that in the final elaboration of the North American representatives of the family the most permanent possible results may be obtained. At the same time we would ask for additional material from all quarters, especially fruiting specimens. We are under great obligations to many botanists, to whom we have already, in earlier papers, given our grateful acknowledgments.

EXPLANATION OF PLATE XVII.—Fig. 107, fruit of Discopleura capillacea; fig. 108, section of carpel of same; fig. 109, fruit of Leptocaulis echinatus; fig. 110, section of carpel of same: fig. 111, fruit of L. divaricatus; fig. 112, section of carpel of same; fig. 113, fruit of L. patens; fig. 114, section of carpel of same; fig. 115, fruit of Ammoselinum Butleri; fig. 116, section of carpel of same; fig. 117, fruit of Apium leptophyllum; fig. 118, section of carpel of same; fig. 119, fruit of Bifora Americana; fig. 120, section of carpel of same; fig. 121, fruit of Eryngium aromaticum; fig. 122, section of carpel of same; fig. 123, fruit of E. diffusum. Fig. 119 is ×5; fig. 107 is ×7; figs. 109, 111, 113, 115, 117, 120, 121, 123, are ×22; figs. 108, 110, 112, 114, 116, 118, 122, are ×40.

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Aethusa, 62
Ammoselinum, 293
Angelica, 60
Apium, 294, 262, 293, 294
Archangelica, 60, 62.
Archemora, 74
Anthriscus, 160
Berula, 262
Bifora, 294
Bupleurum, 159
Carum, 138, 135, 138
Chærophyllum, 159, 160
Cicuta, 263
Coëlopleurum, 62
Coniozelinum, 13
Conium, 62
Crantzia, 262
Cynosciadium, 263
Cryptotænia, 15
Daucus, 264
Discopleura, 291
Erigenia, 14
Eryngium, 295

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